Firm, Sector, Country Heterogeneity and Economic Integration

by

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Abstract

This PhD dissertation studies the effects of some types of asymmetries in the context of international markets. It pursues two main targets: the first one is to implement an efficiency analysis of different degrees of production factors integration; the second one is to shed further light on the determinants of Pricing-to-Market in order to close the gap on the Purchasing Power Parity.

The first part of the work aims at evaluating whether a full integration of countries or regions is always welfare-improving or not. In case it is not, it tries to establish in which cases and to which extent the mobility of production factors should be constrained in order to yield welfare-improvements. Finally, it turns to the point of view of individual markets, by looking at which one gains and which one loses after integration with other markets. Thus, a static general equilibrium framework is provided. It features (many) heterogeneous monopolistic firms, that are aggregated according to a nested CES function. Two different theoretical scenarios are developed: in the first one, all the production factors in the model (i.e. capital and labour) are assumed to be free mobile across markets; in the second one, one of the inputs, namely labour, is restricted at the individual market level. It turns out that, as long as cross-market demand elasticities are homogeneous, the integrated economy always produces an efficient outcome. However, if markups differ across markets, then full integration yields an inefficient level of production due to misallocation of production factors. In this case, a welfare-superior result can be reached for some exogenous restrictions of labour mobility.

The second part of the thesis addresses the Purchasing Power Parity puzzle by focusing on the determinants of Pricing-to-Market. Thus, in order to understand the reasons why firms price their goods differently across national borders, the model by Atkeson and Burstein (*American Economic Review*, 2008) is directly extended in two different ways. More specifically, the original framework explains Pricing-to-Market through both imperfect competition with variable markups and international trade costs. However, it is not able to completely match the actual extent of Pricing-to-Market reported in some countries and, particularly, in the United States; therefore, the main goal is to improve that result. The first extension developed consists in adding fixed costs of production and heterogeneity in country level demand preferences to the reference setting. Evidence of cross-country asymmetry in total household expenditure shares on different goods is provided such as of home bias. The second extension, instead, consists in including heterogeneity in international trade costs. Even in this case, evidence of asymmetry in costs to export is shown. According to numerical results, both the extensions are able to improve the reference work: the extent of Pricing-to-Market predicted is closer to the actual value; furthermore, both the ratio of exports to gross output in manufacturing sectors and the share of manufacturing plants that export in the US market are matched.

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The author declares that, except where explicit reference is made to the contribution of others, this dissertation is the result of his own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

1 Introduction

My thesis wants to give a contribute to a better understanding of the role of some asymmetries in international markets. In particular, I focus on two types of asymmetries: in market competition toughness and in demand preferences. In the first case, I evaluate the effect of heterogeneity in demand elasticities on allocation of production factors across regional/national markets. In the second case, instead, I consider the impact of heterogeneity in country-level demand preferences on international prices.

So, the first part of the work develops a study about economic efficiency of production factors mobility across both symmetric and asymmetric markets. The major target is to evaluate whether a full integration of countries or regions (such as industrial sectors) is always Pareto-efficient or not. In case it is not, I try to establish in which cases and to which extent the mobility of inputs should be constrained in order to yield Pareto-improvements. Finally, I also consider the point of view of individual markets, by looking at which one gains and which one loses after integration with other markets.

In more practical terms, my research pursues the object to assess efficient degrees of labour force integration across national markets, according to the starting population distribution and the degree of asymmetry in market competition level. Furthermore, it focuses on the impact of competition regulation on wages and financial flows in both the regional and international context. Thus, on the one hand, this would allow to shed further light on how effective current agreements on production factors mobility are, especially within the European Union. On the other hand, it would also make possible to contribute to the debate about the economic opportunity of integrating further countries with the current EU members. In fact, one of the key targets at the origin of the European Union is to generate and promote a Single Market and, of course, full integration of input factors, namely capital and labour, is crucial to achieve that goal. However, I argue that, once markets get integrated, free trade of production factors might raise problems as a consequence of asymmetry in markets competitiveness across the countries involved in the agreement. Specifically, as long as markets are asymmetric, once full integration of inputs is allowed for, then an excess of both capital and labour flows could be expected to the relatively more competitive markets, so leading to welfare losses. Intuitively, this would happen because markets with relatively larger demand elasticities, *ceteris paribus*, will turn out to have lower prices of goods and, consequently, larger real wages. Then, (too) many workers will have incentives to leave the markets where firms have larger monopoly power. In addition, an excess of workers moving to one side of the single market could also be associated to an excess of capital moving to the same direction: this is because capital and labour are normally thought of as having some degree of complementarity with each other in the production process. Thus, the final outcome expected is that there are

some parts of the integrated market inefficiently producing "too much" and other parts inefficiently producing "too little".

In order to show how plausible and realistic the allocation efficiency problem can be within the European context, it might be worth to look at the extent of market entry barriers related to both current EU member states and some of the EU candidates (Turkey and Iceland). This is because those barriers might proxy the degree of internal market competitiveness. In fact, as argued in Aghion, Harris, Howitt and Vickers (2001), the level of market competition can depend on the level of entry barriers that prevent new competitors from entering the market and competing with the incumbents. In turn, such barriers might depend on institutional and political factors. So, according to OECD data, in terms of product market regulations, among the EU-15 countries, there is a big gap between Greece, that reports the largest entry barriers (i.e. entrepreneurship barriers, trade and investment barriers and state control barriers), and Ireland and the UK, that report the lowest entry barriers. Moreover, the members that joined the Union in 2004 seem to have larger barriers than the original fifteen members; more specifically, the countries with the largest barriers are Poland and Czech Republic. Among the candidate members, Turkey's barriers exceed the EU-15 ones and can be generally placed in within the top values across the whole Union; Iceland, instead, has got very low barriers. Furthermore, some literature about migration flows across the European Union after the 2004 enlargement (see, for instance, Zaiceva and Zimmermann [2008] and Kaczmarczyk and M. Okólski [2008]) recorded the largest increase in migration outflows from those countries that report the largest entry barriers to those countries that report the lowest market barriers.

Thus, on the one hand, my research work focuses on an aspect of integration of national markets that has not been considered so far, namely possible misallocation problems. On the other hand, it suggests, as a remedy to such a problem, a solution that has been ignored by the previous literature about allocation efficiency. So far, problems related to international factors mobility, particularly within the European Union, have been mostly related to labour markets. Boeri and Brücker (2001) argued that large income and wage asymmetries between the current member states and the candidates had raised many concerns about labour markets and income distribution. More specifically, those concerns regarded living standard of low-skilled workers, that were threatened by an increase of both the inflow of low-cost workers and the outflow of plants from the West to the East. Moreover, issues about economic integration have been also raised within the economic geography literature. In more detail, it has been shown that the common European market has enhanced processes of concentration of economic activities and specialization of economic areas and, so doing, has increased the risk of asymmetric shocks. For example, Amiti (1998) found an increase in the geographical concentration of production within European

countries. She showed that the majority of industrial sectors tend to be more agglomerated within the European Union as a whole. She explained such a result by Krugman's argument: increasing returns-to-scale are more likely to be geographically concentrated within large demand areas and to employ a large proportion of intermediate inputs. Thus, she expected the monetary union to enhance such a geographical concentration and, consequently, the probability of asymmetric shocks. Ottaviano and Purga (1998) stated that, on the one hand, integration of national markets within the European Union was making central regions stronger and stronger because they were able to attract the most modern production sectors; on the other hand, this was weakening the peripheral areas as they could not keep traditional and less productive industries. Finally, Midelfart, Overman and Venables (2003) gave some empirical evidence about clustering and specialization within the EU area: labour intensive industries seem to be more concentrated in the South of the EU, while service sector is more concentrated in the central regions. In more detail, some countries, such as Greece, Portugal and Finland, have manufacturing production structures that are very different from the other countries. They pointed out that trade integration is an incentive to cluster in order to exploit comparative advantages. This is because it lowers producers' need of producing next to consumers. The expected consequence of production specialization is to make EU members more vulnerable to asymmetric shocks. Furthermore, market forces seem to move economic activity from the periphery to the central regions and this cannot be offset by factor price differences anymore.

In addition, integration of European markets has also raised issues concerning fiscal competition. For instance, Cremer and Pestieau (1996) focused on a possible problem coming from the construction of the European Union: income disparities between member states is less economically acceptable than disparities between non-member countries. This makes the need of redistribution higher. However, enhancing free trade of goods and integration of production inputs makes taxation harder. Therefore, it results to be crucial to decrease income asymmetries across member countries. Bolton and Gerard (1997) also implemented an economic analysis that had some implications for the European Union. They showed a trade-off between efficiency gains from unification and costs derived from losing political control within a unified context. So, in order to minimize the costs of integration, it results to be very important to make preferences over fiscal policies more homogeneous. The EU can be helpful in that direction by reducing both per capita income and income distribution differences across countries, through structural funds for regional development, and by increasing labour mobility. Kessler, Lulfesman and Myers (2002) set up a two-country model with two input factors: labour and capital. They assumed that the social protection in each country is funded by a source based tax that is democratically chosen by inhabitants. They proved that integration of only one of the two production resources lowers countries' redistributive ability because of tax competition. However, as

long as the two countries have similar economic and political conditions, fiscal competition results to be reduced if both the input factors are integrated. Finally, Kessler, Lulfesmann and Myers (2003) showed that if countries are symmetric according to their per-capita endowment but asymmetric according to the capital endowment of the majority of voters, world output might be reduced by integration. However, in the opposite case, that is countries differ by per-capita endowment but are similar by capital endowment of the decisive majority, integration is socially preferred to autarky.

Furthermore, with respect to important recent works about misallocation problems due to markup heterogeneity, such as Bilbiie, Ghironi and Melitz (2008) and Epifani and Gancia (2011), on the one hand, I consider two production factors (i.e. capital and labour) rather than one (i.e. labour). This is to investigate the effects of market integration not only on wages but also on financial flows; in addition, it makes the model more empirically testable. Of course, employing two input factors leads to possibly more complicated cases of distortion since the two inputs must interact in the production process and, at the same time, the respective markets they come from can crucially differ in terms of degree of mobility allowed. On the other hand, a different solution to market inefficiency is proposed, that does not imply lump-sum transfers as in the first reference nor subsidies to production as in the second one. More specifically, I propose and quantify an exogenous allocation of labour force that can correct misallocation problems due to markup asymmetry. My solution might be thought of as more feasible, especially in an international context, where fiscal policy instruments are generally hard to be implemented because of difficulties in coordinating them across national borders.

Turning to some details about the theoretical setting I build up, this is a static general equilibrium model featuring a nested CES production function (see Bhaskar [2002]): there are complementarities across sectors, each of which comprise (many) heterogenous monopolistically competitive firms. The model is solved analytically and a closed form solution is provided. Sectors are allowed to vary by demand elasticity. This is to capture the heterogeneity in the toughness of price competition across markets. Indeed many factors, some potentially related to each other, can determine that asymmetry: horizontal product differentiation across firms (Dixit and Stiglitz, 1977), the number of competitors (Dunne, Klimek, Roberts, Xu, 2009), preference for variety (Bilbiie, Ghironi and Melitz, 2008; Epifani and Gancia, 2011), producers' clusters, geographic segmentation and transport costs (Syverson, 2004), institutional factors, such as entry barriers, price controls, operational restrictions, public sector size (Hopenhayn, 1992; Aghion, Harris, Howitt and Vickers, 2001; Ryan, 2006). Even though the latter is just a short list, it shows that demand elasticity might well summarize several features concerning the economic structure, at least from the static point of view. Moreover, I set up two different framework: in the

first one, labour is allowed to be free mobile across sectors (such as capital in both the settings); in the second one, labour is restricted at the industry level. The two settings' equilibria turn out to be crucially different in terms of aggregate production, intermediate inputs costs and factors allocation. In particular, in the second setting wages differ across industries, whilst in the fully integrated economy equilibrium wage is unique such as the rental in both the settings.

My framework is analytically consistent with Epifani and Gancia (2011). The latter is a static model featuring a continuum of industries, that are heterogeneous by productivity and are aggregated according to a standard CES function. Within each industry there are differentiated varieties; in this case, the perceived elasticities at the industry level depends on the number of varieties (that can be heterogeneous across industries) and/or the elasticity substitution in consumption across varieties. Indeed, there are some relevant differences between that theoretical setting and mine. First, according to their model, the number of firms within each sector is low, so that the decision of each firm affects the others and then markups result to be endogenous; according to my model, instead, the number of differentiated competitors in each industry is assumed to be very large, so that markups are exogenous. Second, in the reference setting, firms competing in the same industrial sector are homogeneous in terms of productivity; in my framework, firms are allowed to be heterogeneous by productivity, so that they will charge different prices, produce different quantities and they will not share the same amount of input factors. Third, they model the preference for variety by a proper parameter, that can also be heterogeneous across industries; in my setting, that parameter is assumed to be always equal to one, so that the model results to be neutral with respect to preference for variety. Fourth, one further crucial difference between the two models is in the industry entry mechanism. Epifani and Gancia distinguish between two separate frameworks: in the first one, there is restricted entry and sunk fixed costs are assumed to be zero, so that firms can make positive profits; in the second one, there is free entry and sunk fixed costs are larger than zero, so that competitors will keep entering the industry until profits are turned to zero. My framework, instead, relies on the restricted entry assumption: the number of firms within each industry is given; sunk fixed costs are assumed to be zero and firms' profits can be positive.

In terms of results, the crucial outcome of my model concerns the difference in production factors allocation between the labour restricted economy and the integrated economy. According to the Social Planner, inputs allocation only depends on the relative productivity of the agents (firms) working in the economy. Both the competitive settings I model can actually catch the Social Planner allocation if demand elasticities across all the sectors are homogeneous. However, they both yield an inefficient solution in case of cross-industry markup asymmetry. On the one hand, in the integrated setting, industry level allocation

of inputs depends not only on the relative productivity but also on the demand elasticity of the industry. Specifically, the larger the relative productivity and / or the larger the demand elasticity, the larger the amount of both capital and labour allocated in that industry. On the other hand, in the labour restricted economy, the labour allocation in each industry is given while the capital allocation results to be not only a function of the industry relative productivity and the industry specific demand elasticity, but also of the stock of labour exogenously allocated. Therefore, the major result is that the allocation distortion due to markup asymmetry across industry can be (partially) corrected by an exogenous allocation of labour force. Intuitively, by exogenously managing the distribution of labour force across markets, I can withdraw (part) of the inefficiently excessive amount of labour allocated in the relative more competitive market and move that into the relatively less competitive market. Nevertheless, the solution coming from a labour restricted market is not a first best solution. The reason is that I constrain only one of the two input factors: capital keeps being free mobile even in a (partially) restricted context and, then, is distorted as well as in the integrated setting. In particular, the lower the output elasticity of capital, i.e. the lower the contribute of capital to production, the more effective labour restriction will be in the direction of a first best allocation of input factors.

In order to illustrate the differences between the two analytical frameworks I set up, I also exploit some comparative statics exercises. The target is to graphically compare the outcomes, in terms of both aggregate and individual country level income and in terms of remuneration of production factors, of a two-country economy in a labour constrained market and in an integrated one. In more detail, I take into account two different scenarios: in the first one, the two countries have the same degree of internal competition toughness; in the second one, one country is more competitive than the other. In aggregate terms, I show that, in the first scenario, a completely integrated economy yields a first best result, while the segmented economy produces as much as the one without migration constraints if the population distribution matches the labour force distribution according to the integrated market. In the second scenario, instead, the integrated economy can not yield an optimal result because of inefficient allocation of production factors. In case of exogenous restrictions to labour mobility, the economy can improve its welfare even though the result will be always suboptimal, as long as the other input factor, that is capital, is kept free to move across national borders. At the individual country level, it results that, assuming the capital ownership equally distributed across the two countries, the country with a population that is larger than the labour force allocated in the integrated economy is always better off. Nevertheless, if the population size is lower than the labour force allocated after integration, then the country can be either better or worse off. In particular, it is worse off if the original population size is very small.

Obstfled and Rogoff (2000), addressing the persistence of real exchange rate deviations

for a range of countries, defined that as one the six major puzzles in international economics: the Purchasing Power Parity puzzle. In fact, according to the *Purchasing Power Parity* theory, the real exchange rate is equal to one or, alternatively, tends to turn back to the unity when the long-run ratio changes for some reasons (a weaker version is the *relative PPP*, according to which changes in national price levels are always equal or have the tendency to be equal in the log-run.) So, the second part of my thesis focuses on one of the major reasons that the literature has given so far to such a puzzle, that is pricing-to-market. Krugman (1986), for example, observed that movements of US import prices are not perfectly correlated with movements of exchange rates: this is to make some evidence of pricing-to-market by foreign sellers to the American market. From the theoretical point of view, Krugman concludes that the understanding of pricing-to-market mostly rely on dynamic models of imperfect competition.

Thus, I try to explain what leads firms to pricing-to-market in international markets and, so doing, I want to give a contribute to the PPP puzzle literature. Within this scope, I exploit the model set up by A. Atkeson and A. Burstein (*American Economic Review*, 2008) and I extend that in different ways. In particular, the original framework studied the large and systematic deviations from the relative PPP. The main object was to theoretically address two empirical facts concerning the US economy: first, the terms of trade of manufacturing goods, defined as a country' s ratio of export and import prices relative to its partners of trade, are much less volatile than the Producer Price Index-based real exchange rate for the same type of goods; second, movements in Consumer Price Index-based real exchange rates for manufacturing goods are almost as volatile as movements in Producer Price Index-based real exchange rates for manufactures. The authors explained both the issues by the pricing-to-market argument, that is the choice of individual producers to change the relative price of her output abroad and at home as a response to aggregate international shocks. In more detail, their model relies on two main characteristics: imperfect competition with variable markups and international trade costs (both fixed and "iceberg" type marginal costs.) Thus, firms did not result to completely pass through variations in marginal costs to prices due to the fact that markups depended on the market share. However, imperfect competition with variable markups is a necessary but not sufficient condition in order to have pricing-to-market: in fact, without any trade costs, firms have to face the same competitors both abroad and at home, so that they will have the same markups and charge the same prices in both the markets. Thus, their model results to be able to match many relevant characteristics of international trade and market structure and, particularly, to reproduce actual deviations from the relative purchasing power parity in the US.

The first extension I introduce into the reference model consists in cross-country demand preference heterogeneity and home-bias effect. The intuition is the different pricing

of the same goods across international markets might be due to the fact that consumers from different areas of the world have different tastes that can affect international trade in terms of both quantities and prices. Such different tastes can be due to several factors, of cultural or environmental type. For example, selling Italian coffee in India can be not as easy as in Italy simply because Italian consumers like Italian coffee more than Indian consumers do; selling Chinese noodles in Italy can be a hard business as consumers normally prefer Italian pasta over there. Furthermore, the geographical environment can also matter. In particular, climatic characteristics of markets could affect expenditure preferences. For instance, selling umbrellas in desertic areas might be something really difficult to do with respect to, say, Scotland, such as selling air conditioners in North Africa countries can be much easier than selling them in Arctic areas. As a consequence, even in a more and more integrated international market, the country level total expenditure of households can be distributed in a very different manner over the same panel of goods. So, tastes might determine the size of the market for a particular good; in turn, this could affect the degree of competition between the producers of that good and, consequently, the market power (and pricing) of each of them. Moreover, the effect of preference heterogeneity on international trade may become even more plausible in the form of home bias by taking also into account economies of scale. More specifically, national economies tend to produce more those goods that domestic consumers like more than others in order to exploit increasing returns to scale. The latter imply cost advantages by businesses of larger sizes, due to fixed costs of production.

At the aim of proxying country level demand preferences, I choose Consumer Price Index weights provided by the OECD database, that represent the shares of household final consumption on the same panel of products classified according to the four-digit C.O.I.C.O.P. (i.e. Classification of Individual Consumption According to Purpose). So, I pick up CPI weights data for the US and for five of the top US international trading partners (Canada, Germany, Japan, Mexico and the UK). Then, for each country, I aggregate the weights according to seven broad categories: Food, Housing, Apparel, Transport and Communication, Medical Care, Education and Recreation, Other Goods. By comparing the aggregate weights associated to the broad categories in each country, it turns out that the US have a relatively larger share of total household expenditure spent for Housing and Medical Care and a lower share spent in Food and Education and Recreation. Furthermore, turning to the US trading partners, Mexico and, in a second position, Japan turn out to be among the farthest ones from the US in terms of expenditure shares on Food and Housing, that represent more than half of the total expenditure for most of the countries. Overall, the most homogenous country with the US in terms of total household expenditure shares seems to be Canada; among the European countries, instead, Germany seems to be relatively closer with respect to the UK. Moreover, cross-category

heterogeneity in preferences also varies across countries. In fact, there are countries, such as the US and Canada, where preferences seem to be more concentrated in some categories (namely, Housing and Transport and Communication) with respect to the others. On the other side, in the UK, preferences result to be more evenly distributed across expenditure items. Furthermore, I also provide evidence of the presence of home bias both in the US and in some of the US trading partners, such as the UK. In more detail, I collect data from the OECD database about consumption, production and number of enterprises at the two-digit industry level. In the US, in middle 2000s, consumption and production patterns across different industries result to be very similar: the larger the consumption of the product of a given industry, the larger the production of that industry. In addition, the number of enterprises in a given industry seems also to be positively correlated to the total production/consumption of that industry specific good. Thus, the larger the share of total household expenditure on the product of given industry, the larger the production of that product and the larger the amount of firms that enter that industry. For the UK, in the same period, the positive correlation between consumers' preferences, production and the number of active enterprises across industrial sectors is even more evident.

Thus, I first test a simple extension to the reference work, by only adding heterogeneity in demand preferences. The aim is to understand whether introducing such an asymmetry can improve the ability of the original framework in showing that CPI-based real exchange rates are as volatile as PPI-based real exchange rates. In fact, if actual data say that relative consumer prices move one-by-one with relative producer prices, the model I am referring to is able to address only slightly more than 80 percent of that relationship. Another important target I pursue is to reproduce the actual data in the US on the overall volume of trade, the percentage of exporters and the level of industry concentration at the sector level. Thus, the first economic value concerning the US economy that I consider is the average of exports relative to gross output in manufacturing sectors in the period 1997-2003 (16.5 percent). The second value targeted is the share of US manufacturing plants that export in the period 1987-1992, that is 25 percent. Finally, the third economic value that I try to match in my numerical exercises is the median Herfindahl index across sectors equal to 1,500. In order to make my results directly comparable to those in Atkeson and Burstein (2008), all the common parameters are set at the same values as in the original work. So, the only difference with the latter is the heterogeneity in preferences. Preferences are built up in a way such as to represent the actual distribution of CPI weights across different commodities according to the OECD data. In more detail, country 1 preferences are always proxied with US CPI weights in 2000, while country 2 preferences are proxied with CPI weights of some of the US major trading partners: Canada, Germany, Japan, Mexico and the UK. Considering different countries allows to compare the effect of different degrees of cross-country heterogeneity in preferences on

the prediction of pricing-to-market. In addition, it makes possible to consider different degrees of cross-category heterogeneity in demand preferences, as the countries selected also report different distributions of weights across the expenditure items. Next, I test one further and more complicated extension to the original framework, that considers both heterogeneity in demand preferences and fixed costs of production, so as to capture the home-bias effect: countries should specialize in the production of those goods that domestic consumers prefer to others: this is to exploit increasing returns to scale.

It results that the first simple extension consisting in adding heterogeneity in preferences across sectors and countries does not yield any improvement in the ability of the model to predict the reaction of CPI-based real exchange rate to aggregate shocks relative to the reaction of PPI-based real exchange rate. However, cross-sector asymmetry in demand preferences turn out to (slightly) affect both extensive and intensive margins. This is because exporting to countries where preferences are more concentrated in some sectors is more difficult than exporting to those countries where preferences are more equally distributed across different good. One the one hand, if consumption is more concentrated in some sectors, then the other ones will be so small that exporters will have to struggle to sell any good to them. On the other hand, sectors associated to very large preferences are not able to offset the previous effect by allowing a relatively larger number of exporters to access the market. The more complicated extension, instead, that introduces both preference heterogeneity and fixed costs of production into the original model, yields an improvement in terms of the target variable. Most of the result seems to be led by the introduction of fixed costs of production while, as in the previous case, adding preference heterogeneity across countries did not yield any benefit in terms of prediction of pricing-to-market.

Next, I focus on the role of trade costs and, particularly, of the cross-country heterogeneity in those costs in explaining the extent of pricing-to-market. In fact, even though a part of those costs (mainly related to physical distance) could be thought of as not strongly depending on the direction of the shipping, there is another part that may vary according to the direction, as country specific. Thus, shipping a pair of shoes from Europe to the US might lead to a different trade cost with respect to shipping that pair of shoes from the US to Europe. This is because US exporters to Europe might have to deal with costs related to, for example, wholesale and retail costs, marketing, advertising costs and local transport, that are different in extent from the costs that European exporters have to face when they ship their goods into the US market. In the literature, an important work about international trade costs is Anderson and van Wincoop (2004). They estimated the tax equivalent of "representative" trade costs (for industrialized countries) to be equal to around 170 percent. Those costs included transportation costs (of both freight and time

type), border related trade barriers (i.e. tariff and nontariff barriers, language barrier, different currency, information and security costs) and retail and wholesale distribution costs. Crucially, they reported the fact that some of them can vary across different goods and different countries. In turn, I expect this heterogeneity might generate asymmetries in terms of international trade volumes and prices. In particular, if these costs affect the degree of competition within the national economies by imposing entry barriers to exporters, then the heterogeneity in those costs could also imply different pricing across countries. Thus, *ceteris paribus,* countries that impose lower trade costs to foreign competitors should have more competition within the domestic market and, then, lower prices. On the other side, countries that impose larger barriers to competitors coming from abroad, might have less competition in the market and then larger prices. Consequently, even at the firm level, it might result that the price charged in the domestic market differ from the price charged abroad as a consequence of a different degree of competition in the two markets due to trade costs heterogeneity.

Pursuing the object of giving some evidence of trade costs asymmetry, I collect some data from the World Bank database about two variables. The first variable I consider is the cost to export, that include the fees to completing the procedure to export to a particular country, such as documents, administrative fees for customs clearance and technical control, terminal handling charges, customs broker fees and inland transport. The second variable I take into account is the lead time to export, that is recorded in calendar days. On the one hand, costs to export to the US turn out to be lower than costs to export to Canada, Mexico, Japan, France and Italy that, together, represent almost 50 percent of total US international trade volume. On the other hand, in terms of lead time, exporting to the US takes less than half of the time needed to exporting procedures to Canada, Japan and France and less than one third of the time required to complete the procedure of exporting in Mexico and Italy (the gap becomes even larger when the US are compared to China).

Therefore, in order to verify the effectiveness of this idea, I develop one further extension to Atkeson and Burstein (2008), introducing heterogeneous international trade costs. In particular, I introduce asymmetry in "iceberg" type marginal costs. Even in this case, all the parameters that are in common with the original framework are set at the same values. Iceberg costs are set so as to match actual data according to which, as said before, exporting to the US implies lower costs than exporting to most of the US most important international trading partners. Thus, in terms of results, it comes out that introducing asymmetry in iceberg costs can improve the ability of the reference model to predict the actual extent of pricing-to-market. Asymmetry in trade costs implies, *ceteris paribus*, a different number of competitors across the two countries. Assuming that the number of domestic competitors is the same, more exporters will enter the country that is

associated to relatively lower trade costs (the US.) Then, this is going to affect the market shares that each competitor (both domestic and foreign) can hold in the two markets: a relatively larger number of competitors in the economy yields lower market shares and, consequently, lower market powers. Therefore, such a heterogeneity in trade costs can enhance the difference in market share that each exporter has in the respective domestic and foreign market and, then, the extent of pricing-to-market. It is worth to remind that the reference work proved that pricing-to-market occurs if the elasticity of markup varies with firm's market share and market shares at home and abroad are different, and (or) if market shares at home and abroad react to shocks to aggregate costs in a different way.

2 A Literature Review

2.1 Economic integration: is it always efficient ?

The first part of my research is an efficiency analysis of markets integration. In particular, I theoretically study the opportunity to integrate markets that can be asymmetric in terms of productivity, size and demand elasticities. By markets here, I mean both spatially defined markets, such as regions or countries, and good specific markets, such as industries. Moreover, by integration, I mean dropping barriers to production factors, namely capital and labour. Thus, I compare a fully integrated economy with a partially integrated economy: in the first one, both the input factors assumed, i.e. capital and labour, are assumed to be free mobile across all the markets in the economy; in the second one, one input factor is allowed to cross markets' borders, while the other one is constrained at the level of each individual market. More specifically, in the second case, I assume a single capital market, in that capital flows freely between countries, regions or industries, and a restricted labour market. The latter models the difficulties of labour migrating across international barriers (in a trade context) or from a poor region to a richer one (in a regional context). Therefore, I am going to exploit such a framework mainly to study the impact of competition regulations on wages and financial flows both in the regional and in the international context, and the output, welfare and financial implications of allowing free labour mobility across markets. In more practical terms, one object of this research work is to possibly contribute to the current debate about the size of the European Union. While the global financial crisis is still running, some economists and policy makers are wondering if criteria adopted to build up the current EU are sufficient to guarantee the survival chances of the Union itself. Furthermore, the opportunity to add the other candidate countries (Croatia, Island, Macedonia, Montenegro, Turkey) to the current members is still under evaluation.

Thus, I think that such a framework can rely on different literatures, that I am going to shortly review next. First of all, my study can be related to more general international trade issues. In fact, the standard Heckscher-Ohlin-Samuelson (HOS) model predicts that international prices of input factors equalize as an effect of international trade. According to that theory, the latter makes the price of each country's scarce input factor fall until it converges to the international common price. Therefore, international trade and international integration of input factors can be regarded as substitute as long as they both lead to the convergence of inputs prices. Then, at least from this point of view, barriers to production factors mobility and to final goods trade might also seen as strongly related to each other.

2.1.1 Productivity heterogeneity and trade

In particular, so much work has been spent in the last years to highlight how international trade enhances productivity by selecting the most efficient competitors. From the theoretical point of view, Melitz (2003) set up a pioneering model that explains welfare gains from international trade though intra-industry reallocation. In more detail, the model features a continuum of monopolistically competitive firms, each of which produces a different variety. Moreover, there is only one input factor, i.e. labour, that is inelastically supplied at the aggregate level and represents the size of the economy. In particular, although all firms deal with the same fixed cost of production, they are heterogeneous by productivity level: the higher the firm level productivity, the lower the marginal costs (however, one further meaning of such a heterogeneity is that, assuming production costs to be equal across firms, the higher the productivity the larger the quality of the variety produced.) Therefore, a larger productivity leads to lower prices and larger outputs, revenues and profits. This asymmetry turns out to be crucial for the entry/exit mechanism. Firms wishing to enter the market have to face fixed (sunk) entry costs: firms with a low productivity are supposed to exit the market as they are not able to make profits that are high enough to cover such costs. Opening the market to international competition makes the latter mechanism even tougher. In fact, Melitz proved that international trade makes the most efficient firms increase their market shares and profits. This happens because entry costs to production result to be increased when markets are opened to international competition. Thus, because labour is inelastically supplied, the increased labour demand by the more productive firms and the new entrants increases the real wage and pushes the least productive agents off the market. As a consequence, aggregate productivity, that is a weighted average of (surviving) firms' productivities results to be increased. On the more empirical side, several works showed as international competition forces the least productive firms to exit the market by imposing tougher competition; in addition, it increases the probability to survive of the most efficient competitors. For example, I might start with a very important work, that is Bernard and Jensen (1999). The latter is an empirical study that tests and compares two different hypotheses (both holding within Melitz[2003]) about the relation between firm level productivity and international trade. According to the first hypothesis (*self-selection hypothesis*), the more efficient firms become exporters; this is because entering the export market often implies covering high sunk entry costs, so that only the "good" firms can make nonnegative profits by selling abroad. According to the second hypothesis (*learning-by-doing hypothesis*), exporting boosts firms' performances and, in particular, firms' productivities. Thus, they worked on US data and found clear evidence on the first hypothesis: both growth rates and levels of performance variables are larger for exporters before the entry into the export market. In more detail, the exporters turned out to produce double and to be up to 19 percent more productive with

respect to non-exporters in the years just before starting to sell abroad. However, positive effects of export on firm performances resulted to be less clear: even though employment growth rate and the probability of survival came out to be both larger for exporters, productivity and wage growth rate were not found to be significantly larger for the same group of firms, especially for longer horizons. Aw, Chung and Roberts (2000) studied the same two hypotheses on both Taiwan and Republic of Korea data. In the Taiwanese case, they found that exporters show higher productivity before entering the foreign market with respect to non-exporters; however, in some industries, there is also evidence of productivity improvement after the entry. In particular, the increase in the productivity gap after entry was explained by direct benefits from exporting, such as knowledge spillovers from foreign buyers. Furthermore, plants that keep exporting resulted to be more productive than those exiting the export market. In the Korean case, instead, there is less evidence on both the hypotheses: before the entry into the foreign market, there were found no significant differences between firms starting exporting and firms keeping out of the foreign market. Moreover, there was no evidence of learning-by-exporting either; finally, export exit did not result to cause performance worsening such as for Taiwanese firms. Pavcnik (2002) developed an empirical study about the effects of trade liberalization on plant productivity in Chile. This was a very interesting case as Chile had chosen to massively open its domestic market to foreign competition between the late 1970s and the early 1980s. Thus, they estimated the impact of trade on plants' efficiency by distinguishing between traded and non-traded goods sectors. Using data on a panel of manufacturing firms, it was found evidence that, as an effect of an increase in international trade openness, plants in the import-competing sector improved their productivity. In particular, in many cases the increase in aggregate productivity seemed to depend on the reallocation of resources to the relatively more efficient producers.

2.1.2 Trade, market size and competition toughness

Some further works focused on the relation between market size and competition toughness. One of those is Campbell and Hopenhayn (2005), that is an empirical study on the effects of market size on the size distribution of American establishments for the major industries across a large number of US cities. Thus, they mainly found that market size and employment/sales at the producer level are positively correlated (by market size they mean the number of consumers, that is the population size). In particular, the work showed that the larger the market size, the larger the number of producers (less than proportionally), the lower markups and producers' prices and, finally, the larger the sales of each producer. Furthermore, relying on a model featuring competition between many producers, the elasticity of producers' average sales to market size turned out to be a lower bound for the toughness of price competition. Next, Melitz and Ottaviano (2008) is

a monopolistically competitive model of trade with firm heterogeneity. National markets are assumed to differ by size and are not perfectly integrated through trade. Moreover, asymmetries in the toughness of competition are endogenous: they depend on the number of competitors and on average productivity. However, trade costs are assumed to be symmetric. Thus, they found that larger and more integrated markets show higher productivity, lower markups and, consequently, lower prices. In particular, bigger markets have a larger number of competitors and a higher level of product variety; furthermore, firms are more efficient, produce larger outputs and make larger profits (because larger demand outweighs the effects of lower markups and prices). Therefore, trade turned out to have pro-competitive effects due to the reduction of markups and, then, prices. The latter model was empirically tested by Chen, Imbs and Scott (2009). Thus, working on disaggregated data for a panel of EU manufacturing firms, they found that, at least in the short run, trade openness has a pro-competitive effect. In particular, they provided evidence that an increase in openness to trade lowers prices and markups and raises productivity and profit margins. These results were the estimated effect of the increased access of foreign competitors to the domestic market, due to a decrease in trade barriers. However, in the long run, results are more ambiguous and, sometimes, show anti-competitive effects.

One further important recent work about gains from international trade is Bernard, Redding and Schott (2007). This is a two-country model with two sectors and a continuum of heterogeneous firms; countries differ by factor endowments and sectors vary by factor intensity (Heckscher-Ohlin comparative advantages hold). The main result was that falling trade costs leads to reallocation of resources within industries and across both industries themselves and countries. In addition, this reallocation causes significant job turnover in all sectors and boosts relatively more creative destruction in comparative advantage sectors with respect to comparative disadvantage sectors; thus, it magnifies ex-ante comparative advantage and generate additional welfare gains from trade. Furthermore, improvements in aggregate productivity reduces and can also reverse the losses in terms of real wage of scarce factor. In addition, a really rich framework that studied the relation between international trade openness and government size is Epifani and Gancia (2009). The latter developed a static model of a world economy featuring a larger number of identical countries in each of which there is a continuum of industries. Consumers' utility relies on the consumption of differentiated goods and a country-specific public good. Governments functions are twofold: first, they produce public goods that are financed through taxation and, second, they insure against the risk of idiosyncratic shocks through transfers. In addition, they unilaterally set policies in order to maximize domestic citizens' utility. Trade is assumed to happen because consumers like variety. Moreover, economic integration between countries is imperfect because in some sectors trade costs are prohibitive. Finally, labour mobility across sectors is also limited by both sector-specific human capital and

labour market frictions. Turning to the implications of this model, it resulted that trade openness can enhance the size of governments in two ways: first, it reduces the domestic cost of taxation (terms-of-trade channel); second, it boosts risk and public transfers (demand of insurance channel). The first channel turned out to be inefficient from the point of view of world welfare: the government set taxes to finance public spending but the induced improvement of terms of trade lowers the cost of public spending that, consequently, are not fully internalized by policy makers. However, the second channel resulted to be Pareto optimal. Indeed, the power of the two channels mentioned above depends on the degree of substitutability between domestic and foreign goods. It might be worth highlighting that these results took this work into the debate about the coordination of fiscal policies imposed by the Stability and Growth Pact. Particularly, the authors claimed that limits to budget deficits and debt can not tackle the inefficiencies studied in the paper that, instead, depend on too high level of public spending.

2.1.3 Efficiency of input factors allocation

Thus, turning to a description of my work, it first aims at making further theoretical evidence of the allocation inefficiency that is implied by mark-up heterogeneity across sectors: in case of demand elasticity asymmetries, input factors allocations is driven not only by productivity forces (i.e. the input factors demand is proportional to the relative productivity of producers) but also by monopoly power distortions. Particularly, there will be an excess of input factors within those sectors/markets with a relatively larger demand elasticity; in turn, industries or regions where monopoly power is relatively larger will result to be in deficit of input resources. Thus, taking both perfect competition, i.e. prices equal to marginal costs, and perfect homogeneity of mark-ups across all the goods as fairly unrealistic cases, I think it can be worth going deeper into the study of factors misallocation other than looking for possible economic remedies.

As Lerner (1934) and Samuelson (1947) first pointed out, optimal allocation of resources is implied by synchronization of monopoly powers in the pricing of all the goods. In fact, what really matters in order to have an efficient allocation across firms/industries is that they all impose the same markup over their marginal costs. In that case, relative prices perfectly reflect relative costs across the goods and this leads to optimal allocation[1] . Therefore, an efficient allocation is not prevented from monopoly power *in sè*, but from deviations of markups.

The concept of misallocation is been applied to several fields in economics. First, Adão, Correia and Teles (2003) set up optimal monetary policy within a framework without capital featuring cash-in-advance restrictions, sticky prices, and monopolistic competition.

[1]See also Koeniger and Licandro, 2006, that also showed relative prices are not distorted by demand elasticities as long as markups across the goods are all the same.

They found that if prices are flexible, only the interest rate matters: the optimal monetary policy is to set the nominal interest rate equal to zero, so that the wedge between the marginal rate of substitution and the marginal rate of transformation is minimized; however, the optimal allocation turns out to be still distorted by a constant mark-up, because of the zero bound on the interest rate. Under sticky prices, instead, the optimal allocation leads to variable mark-ups; the planner is able to exploit not only the interest rate but also the money supply, so that she is able to get higher utility. An important recent work about this subject is also that by Bilbiie, Ghironi and Melitz (2008), within a dynamic stochastic general equilibrium model. They proved that the market economy is efficient if and only if symmetric, homothetic preferences are of the CES form studied by Dixit and Stiglitz (1977). CES-DS preferences lead to synchronization of markups across goods and over time; furthermore, they make the benefit of variety in elasticity form be identical to net markup in the pricing of goods and, so doing, perfectly balance two contrasting forces that are the "consumer surplus effect" and "profit destruction effect" (see Grossman, G. M. and Helpman E., 1991). Furthermore, Hsieh and Klenow (2009) showed that input factor misallocation can explain lower aggregate total factor productivity in China and India with respect to the US. Particularly, there are two different sources of distortion: one affects the marginal products of both the input factors, namely capital and labour, by the same proportion as an output distortion (for example, government restrictions on size, transportation costs, public output subsidies); the other one hits the marginal product of capital relative to labour (for example, easy access to credit through business groups or state-owned banks). Thus, they found that if production factors were reallocated according to the US plant-level marginal products within each four-digit sector, aggregate total factor productivity would significantly increase in both China and India. Finally, Epifani and Gancia (2011) showed that asymmetric exposure to international trade can contribute to markup heterogeneity across industries; in turn, the latter always leads to intersectoral misallocation. If firm entry is not free, then that misallocation can imply a welfare loss; instead, if it is free, markup asymmetry does not always lead to a welfare reduction as policy makers can improve input factors allocation by supporting those industries that are relatively less competitive (i.e. with lower demand elasticity). Therefore, international free trade and domestic industrial policy can be complementary.

2.1.4 Different sources of market power

In order to justify my interest to allocation problems due to markups asymmetry, it might be worth to make clear what these markups actually represent and what can determine them. Indeed, markups give an idea of the toughness of price competition in the market. In turn, such price competition can depend on several factors. Of course, one of the major factors is represented by the number of competitors. In turn, the latter is generally a

function of the sunk entry costs: the larger those costs, the lower the number of different products within the same market. The role of entry costs in determining the strictness of competition was highlighted by Spence (1976). He pointed out that they affect market structures and impose a non-competitive pricing. Furthermore, they limit the number and the variety of products that can be supplied to the market. In fact, the probability of entering the market crucially depends on the profitability of that choice: thus, in order to make nonnegative profits, revenues must cover the fixed costs and the variable costs. Therefore, the larger the fixed (entry) costs, the lower the number of competitors for which getting into the market will be profitable. Bresnahan and Reiss (1987) developed an empirical work on US data. They used a geographical definition of market (that is meant as a town) and assumed there could exist different types of industries: an industry containing no firms, a one-firm monopoly industry, a two-firms duopoly industry and more than two firms industry. The type of the industry was thought of as depending on profits, that were assumed to be increasing linear functions of market size. Moreover, each further competitor had to deal with entry costs (barriers) that were imposed by the former incumbent competitors. Thus, empirically, they found that entry barriers significantly varies across industries. In particular, there were relevant differences between professional industries and retail industries: the first ones turned out to have larger entry costs. One further empirical work on US data about the role of entry costs is Bresnahan and Reiss (1991). In this work, the authors estimated a model of entry in atomistically competitive markets. Thus, they mainly showed that the number of producers in oligopolist markets varies by the conditions of demand and market competition. In addition, post-entry competition increases at a rate that decreases with the number of incumbents. In fact, they estimated that most of the increase in competition comes with the entry of the second/third firm. One further relevant reference on this subject is Schmalensee (1992), that provided a review of John Sutton's *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*. The latter is a work that provided evidence about differences in industry concentration. In theory, such differences might be due to the toughness of price competition (that, in turn, can be determined by the level of horizontal differentiation) and, particularly, market size. Thus, the relation between industry concentration and market size is estimated; furthermore, inter-industry along with international comparisons are also employed. In more detail, two types of markets are distinguished according to the relevance of advertising: the latter concerns only the market of the second type. So, in the first market type, the lowest possible concentration degree tends to zero as the market size increases; in the second market type, instead, the lower bound converges to a strictly positive value. The latter result is explained by the fact that advertising creates an entry barrier and reduces profit growth. Next, Berry (1992) estimated an oligopolistic model of entry in the airline industry. This paper focused on inferences

about firm-relative sources of profit in case of a large number of heterogeneous potential entrants into the industry. Thus, it is revealed how important the role for airport presence in determining airline profitability. Furthermore, through a simulation estimator, it is showed that profits decrease quite rapidly in the number of entering firms. However, even if the number of potentially profitable firms rises, the number of firms actually entering the market resulted to be limited by within market competition. Finally, they claimed to be able to give more precise estimates of the effect of policies to increase airport access with respect to simple models, such as probit, that rely only on firm heterogeneity but not on interactions between firms and that might then provide exaggerated results. Hopenhayn (1992) set up a dynamic stochastic model for a competitive industry which endogenously determines both processes for entry and exit and output and employment for individual firms. Thus, the work employed a stationary equilibrium analysis in order to extend standard long-run industry equilibrium theory to take into account entry, exit, and firm dynamics. In particular, the intuition behind their model comes from two empirical facts related to the process of job/firm turnover: first, firm level dynamics is dominated by firm relative uncertainty; second, entry and exit rates are strongly correlated across industries (i.e. there are high and low turnover industries). Therefore, they found that markets with larger sunk costs show low rates of producer turnover. Moreover, existing firms turned out to be protected from competition pressures by large entry costs. Aghion, Harris, Howitt and Vickers (2001) shed further light on the relation between competition intensity and innovation and growth. They reached two main findings. First, some competition can be growth-enhancing. In particular, if both product market competition and imitation are allowed to vary together, then the maximal growth rate is achieved in correspondence of the maximal degree of competition. Therefore, the Shumpeterian effect of tougher competition can be outweighed by increasing incentives for firms to innovate (even though this can reduce the overall level of profits); those incentives come from the need to escape competition with "neck-and-neck" rivals. Secondly, they found that a little imitation can also be growth-enhancing (nevertheless, too much turns out to be harmful). So, the usual Shumpeterian effect of imitation keeps holding for large imitation propensities; however, it results to be outweighed by the composition effect of enhancing "neck-and-neck" rivalry when that propensity is relatively low. Syverson (2004), instead, developed a spatial competition model. In the product market, the degree of substitutability depends on how clustered producers are: the more clustered in the market they are, the easier for consumers to switch between suppliers and, then, the more competitive the market. In particular, the larger the competition in denser markets, the harder for less efficient competitors to make positive profits. Thus, an increase in demand density (i.e. demand per unit area) in local markets truncate distribution productivity of producers from below. Furthermore, tougher markets also comprise, on average, larger size producers. In addition, demand

density also depends on how large transport costs are. So, lowering transport costs can enhance productivity in two ways: first, less resources are needed to move goods around and, second, competition within spatially differentiated industries increases and market shares result to be reallocated to the more efficient producers. Aspland and Nocke (2006) set up a stochastic dynamic model of monopolistic competitive industry to study the effect of fixed costs and market size on entry (exit) rates. Thus, they showed a stationary equilibrium with simultaneous entry and exit. According to that equilibrium, efficient firms are able to survive, while inefficient producers are replaced by new entrants. In particular, they found that the level of turnover is increasing in fixed costs and market size: in large markets, competition is tougher than small markets, so that the price-costs margins are lower. In addition, in terms of effects of market integration, a larger market implies larger turnover; however, larger turnover also leads to a multiplication of entry costs and the latter might imply inefficiency. The work also included an empirical part on Swedish data: they found that an increase in market size or fixed costs shifts the age distribution towards younger producers. Ryan (2006) built up a dynamic model of oligopoly to study the effects of environmental regulation on the cement industry in the US. In more detail, the work exploited a two-step estimator which takes into account the whole cost structure of the industry, that is both sunk entry costs and adjustment costs of investments. Thus, the main result was that regulation leads to larger sunk costs and lower entry rate. As a consequence of lower entry rates, welfare fell because the amount of production turned out to be inefficient. Berry and Reiss (2007) provided a literature review on market structure and competition. In the short run, the number of competitors is given; price or quantity competition leads to firms' profits that depend on the market structure and, then, on the toughness of competition. In turn, the latter is a function of several different factors: product differentiation across firms, geographic segmentation of the markets, level of transport costs, structural factors such as collusion, price-quantity competition, productivity and production costs heterogeneity across firms. A more recent work focusing on the relation between toughness of price and the number of competitors in Dunne, Klimek, Robert and Xu (2009). This is an empirical work on US data, that estimates a dynamic structural model of firm entry and exit decision within an oligopolistic industry. The market structure depends on the entry/exit decision of individual producers and that decision depends on the expectations of future profits. In turn, those expectations are determined by the nature of competition within the market. Thus, they found that the larger the number of competitors, the tougher the price competition. In more detail, as the number of competitors increases, the value of both keeping producing within the market and entering the market falls, so that the probability of enter decreases and the probability of exit increases. Empirically, they estimated that a seven percent reduction in the average sunk entry cost would decrease the lon-run profits of a monopolist by the

same amount as if the firm competed within a duopoly economy.

Furthermore, imperfect competition has also been used to explain some "core-periphery" patterns within international economics. Krugman and Venables (1990) illustrated the effects of the integration through a model with one "central" country featuring a large access to market and one "peripheral" country with a smaller local market. Furthermore, in their model there are two sectors: one with constant return-to-scale and the manufacturing one with imperfect competition. Thus, they showed that reduction of trade barriers moves production of the manufacturing sector towards the "central" economy: this happens because when barriers are still high (in the short run), there are cost advantages in producing manufacturing goods next to the larger market[2] . Krugman (1991) explained the emergence of a "core-periphery" pattern as depending on transportation costs, economies of scale and the share of manufacturing share in the national income. He assumed there exist two sectors (one competitive, that is agriculture, and one with increasing return-to-scale, that is manufacturing) and two input factors (one immobile, that is land and one mobile, that is labour). Because of economies of scale, production of manufacturing goods results to be placed at only a limited number of places: this is to be closer to a larger demand and, thus, to minimize the transport costs. From the labour market's point of view, the concentration of production within a few locations enhances employment conditions for workers with industry-specific skills and also reduces the probability of labour shortage for firms. In turn, a larger demand for manufacturing goods will move to those places where manufacturing production is more concentrated ("circular causation"). One further relevant reference, at this point, is Ottaviano and Thisse (2002) tried to address some worries concerning full labour markets integration across the European countries, so stated by the European Commission in 1999: "it could be in the advantage of the new members to restrict this right for a set period of time. The economies of the applicant countries are more likely to suffer a brain drain and loss of a valuable part of [their] young mobile workforce if early, unrestricted liberalization of labour markets is granted." They set a two-region model featuring two sectors (one "modern" and one "traditional") and two input factors: one is skilled workers (free mobile) and the other one is unskilled workers (immobile). They proved that the market leads to an efficient solution when trade barriers are either high or low. Instead, for intermediate values of barriers, there is agglomeration of the modern sector even though dispersion would be socially efficient. This happens because the unskilled workers in both the regions have to deal with pecuniary externalities as skilled workers move from one region to the other; furthermore, skilled workers neglect the effect of their move on the other skilled workers. This model seemed to well represent the EU case as intermediate trade barriers might be a good proxy for shipping

[2]However, in the long run, trade barriers become lower and production moves back to the peripheral economy, that has got lower production costs (i.e. wages).

costs between medium-sized markets, such as those in the European Union. Finally, Redding and Venables (2004) pointed to geographical factors as important determinants for cross-country differences in per-capita income. Thus, even if trade barriers are lowered, the distance from large demand markets will keep remote regions' income down.

2.1.5 Some issues concerning economic integration and fiscal competition

Indeed, the integration of input factors, especially across the EU countries, has also raised issues concerning fiscal competition. Epple and Romer (1991) built up a model with the following primary features: there are two goods (housing and a composite good), many communities with a continuum of households, a tax (chosen by the local government) that is proportional to the value of property, uniform redistribution among the inhabitants of proceeds coming from such a tax, free mobility individuals across communities; moreover, the tax rate, the tax base and the population of each jurisdiction are endogenously determined. By such a model, they found that local redistribution leads the poorest households to move to those communities that provide more redistribution. Furthermore, the local decision on the level of redistribution crucially depends on the share of inhabitants that rent capital: the larger that share, the more the community will be keen to redistribution. Cremer and Pestieau (1996) set a two-country model featuring a Ricardian production function. They highlighted a possible problem coming from the construction of the European Union: income disparities between member states is less economically acceptable than disparities between non-member countries. Consequently, the need of redistribution becomes higher. However, enhancing free trade of goods and integration of production inputs yields makes taxation harder. Tougher competition imposes keeping production costs low by reducing taxes on both capital and labour. In turn, expenditure in social protection and public good is expected to decrease. Therefore, it turns out to be crucial to decrease income asymmetries across member countries. Bolton and Gerard (1997) built a model about the breakup or unification policies of democratic nations. The equilibrium outcome is the result of a trade-off between efficiency gains from unification and costs derived from losing political control within a unified context. Their analysis led to some implications concerning the European Union. Particularly, in order to minimize the costs of integration it results to be very important to make preferences over fiscal policies more homogeneous. The European Unification can work into that direction by reducing both per capita income and income distribution differences across the European countries (mainly through structural funds for regional development); furthermore, enhancing labour mobility also helps to make such preferences more similar: in fact, they theoretically proved that if all production factors are fully mobile, then all incentives to break up collapse. Hindrinks (2001) created a model of redistribution assuming that both rich and poor people are imperfectly mobile and, moreover, that each jusrisdiction sets the

redistributive policy through majority voting. It is first showed that mobility restrictions (such as zoning requirements, immigration policies and housing markets, among others) are detrimental to redistribution. Moreover, majority voting can lead to inefficiency if it affects membership: particularly, poors can vote against a Pareto-improving tax reduction as it could push more rich people to move into their jurisdiction and, so doing, change the majority. Kessler, Lulfesmann and Myers (2002) set a two-country model with two input factors: labour and capital. The social protection in each country is funded by a source based tax that is democratically chosen by inhabitants. They found that integration of only one of the two production resources reduces countries' redistributive ability because of tax competition. If both the input factors are integrated, instead, fiscal competition turns out to be reduced. If the two countries have similar economic and political conditions, unilateral tax cuts attracts more capital and, consequently, raise wages and per capita social transfers. If, in addition to capital, also labour is integrated, then larger wages and public transfers causes detrimental immigrations. Thus, incentives to exploit unilateral tax cuts to get more capital fall as labour becomes more and more integrated across national markets. However, assuming ex-ante asymmetries in population size might change the outcome of their analysis: particularly, integration could be worsening for the smaller country. Kessler, Lulfesmann and Myers (2003) set up a two-country model where goods are producing by combining domestic labour and capital. The redistributive policy, that is chosen by the majority of inhabitants, relies on taxing capital that is locally employed and redistributing benefits. Furthermore, per-capita stock of capital owned by the country's decisive majority is less than that owned the whole country's one. They showed that if countries are symmetric according to their per-capita endowment but asymmetric according to the capital endowment of the majority of voters, world output might be reduced by integration. On the other side, in the opposite case, that is countries differ by per-capita endowment but are similar by capital endowment of the decisive majority, integration is socially preferred to autarky.

2.1.6 Constitution and efficiency of trade blocs

One further strand of literature I might relate to is that about trade blocs. The latter are forms of international agreements aimed at reducing or eliminating trade barriers among the participating states. Some examples of trade blocs around the world are: EU (European Union), NAFTA (North American Free Trade Agreement), LAFTA (Latin American Free Trade Agreement), MERCOSUR (Southern Common Market, in South America) and ASEAN (Association of South East Asian Nations). Thus, I might start by mentioning the work by Krugman (1989). In his model, he split the world into basic geographical units called "provinces", that are symmetric by size and preferences. Each of them is specialized in the production of one good that is an imperfect substitute with the single

goods produced by the other provinces. Furthermore, provinces are grouped into symmetric "trading blocs", each of which contains the same number of components. In particular, "blocs" are defined as areas with internal free trade and a common external *ad valorem* tariff. Thus, because provinces are assumed to be symmetric, blocs formation does not affect the internal income distribution. Moreover, it will reduce the interbloc trade and it is also likely to decrease the world welfare. However, considering both high transport costs and high negotiation costs (that are needed to set real world trade policies) can weaken the latter result. Wei and Frankel (1995) made an efficiency analysis of "continental" trade blocs, that are particular trade blocs grouping more countries on the same continent (they are also defined as "natural" trade blocs by Krugman, in order to distinguish them from "unnatural" trade blocs, that are trade agreements between countries that are far away). Particularly, they exploited the idea of "open regionalism" in order study in which cases trade blocs can be Pareto-improving. Thus, by open regionalism they meant a type of international agreement that aims at reducing the external trade barriers: participating countries are supposed to collectively reduce their external barriers from countries that are outside the area. Thus, they found that this trade strategy, that is based on a modest external liberalization, can lead to Pareto-improvement. Furthermore, it turned out to be a more plausible strategy than that implied by the McMillan condition: that is trade blocs should not lower trade volume with no-member countries. However, the latter condition would mean a dramatic reduction in trade barriers, that is normally hard to achieve for political reasons. Frankel, Stein and Wei (1996) shed light on the trade-off between trade diversion and trade creation in case of trade blocs strategy. They argued that the opportunity of Regional Trade Agreements actually depends on the magnitude of transport costs, that determines the optimal level of the extent of regionalization. Thus, if such optimal level is exceeded, then RTA's become detrimental. More specifically, they set monopolistic competition model of trade featuring increasing returns to scale in production and love for variety from the consumers' side. Furthermore, they assumed the world split into three continents, each of which comprising the same number of nations. So, they mainly focused on intermediate values of transport costs and found out by simulation the optimal level for the formation of RTA's. In fact, for the extreme values of those costs (i.e. zero or "prohibitively large"), the answer about the opportunity of RTA's was already clear. As already argued by Krugman (1991), in case of prohibitive trade costs the formation of continental ("natural") blocs was optimal. On the other side, in case of no transport costs, a three-blocs world was considered detrimental: this is because each of the large trade blocs would have been keen to overexploit its monopolistic power by levying too high trade barriers; furthermore, the elimination of tariff barriers within blocs generates more distortions than it eliminates. Bond and Syropoulos (1996) set up an exchange model featuring N countries and N goods. Moreover, they assumed preferences on goods,

that are represented by a CES function, to be identical across the countries. Thus, they analyzed the consequences of splitting the world into trading blocs, that are identical in a first stage, and then of different size. In particular, blocs were assumed to work as custom unions and to set external tariffs on imports from the rest of the world in a non-cooperative fashion. So, they found that, when blocs are symmetric, their market power may be either increasing or decreasing in the absolute size: it is increasing if they have a large degree of comparative advantage; it is decreasing when the demand is really large. However, when blocs are asymmetric, the market power of trading blocs is increasing in the size. Finally, the efficiency of bloc expansion depends on the number of trading blocs.

Sang-Seung Yi (2000) also shed light on the welfare effects of the formation of free-trade area. Here, it might be worth mentioning the difference between free-trade areas and custom unions: members of the first ones set external trade tariffs individually, while member of custom unions set common external tariffs. So, this work proved that the welfare of nonmember countries of large trading blocs depends on whether member countries can exploit their monopoly power in changing terms of trade. In particular, on the one hand, setting a free-trade area makes nonmember countries better off as member countries do not jointly exploit their market power in order to influence terms of trade; on the other hand, setting a custom union makes nonmember countries worse off as, in this case, member countries can exploit their monopoly power to affect terms of trade. Therefore, this work led to the conclusion that the formation of free-trade areas is Pareto-improving as member countries are expected to maximize their individual welfare. Nevertheless, a global free-trade area may not be stable solution because of free-riding problems.

Furthermore, Bond and Park (2002) studied the welfare effects of the "new regionalism", that is trade agreements between small and large countries. Historically, two fairly famous examples were the Accession Agreement (1971) between the UK and the European Community and the Interim Agreement (1992), between Poland and the European Union. Further and larger examples are the North American Free Trade Agreement and the Euro-Mediterrenean Partnership (1995). Benefits from this type of agreements are different for small and large countries. In more detail, on the one hand, small countries aim at gains in terms of terms of trade through a reduction of tariff barriers to larger markets and an exemption from antidumping duties and other forms of protection; on the other hand, large countries benefit , for instance, from concessions on protection of intellectual property and laws concerning foreign investments. Thus, turning to the model, partial equilibrium model of trade featuring two goods and two countries (one "small" and one "big"). Preferences of each country on trade agreements are derived from maximizing respective national welfares. Then, a trade agreement results to be a sequence of tariffs and side payments to be paid by each country at each time; particularly, that agreement is self-reinforcing in a repeated tariff-setting game between the member countries. Thus, this framework

studied how to exploit variation of payoff in order to relax only one country's incentive constraints in trade agreements between asymmetric countries and how to reach a gradual reduction of tariff rates by time. In summary, they used an intertemporal distortion to reduce the static trade distortion over time. Fung and Schneider (2005) also focused on trade agreements among asymmetric countries. So, they set up a standard repeated game framework with imperfect competition, that showed, in summary, as integration is not welfare improving. In particular, they allowed for asymmetries in market size, wage levels and labour productivity. The first result is that in case of market size heterogeneity, the relatively larger market country is more likely to defect; in fact, cooperation turns out to be a decreasing function of such asymmetry: therefore, the agreement becomes feasible only by transfers from the small country to the large country. Secondly, in case of cost asymmetries (in terms of both labour productivity or wages), they showed that making countries more similar to each other does not necessarily enhance cooperation and, eventually, might also reduce that. Particularly, the more efficient country is more likely to defect; furthermore, cutting production costs in the relatively less efficient country might make the agreement less feasible. Finally, in case of asymmetries in both market size and production costs, they found that either the countries might defect depending on how such asymmetries are. In more detail, the relatively smaller and less efficient member country is more likely to defect from the agreement, so that it is possible to observe transfers from the North to the South (such as those observed during integration into the European Union of Portugal and Spain). Moreover, they showed that the larger the domestic market, the lower the feasibility of trade agreement; on the other side, the larger the size of the foreign market, the larger the opportunity of the agreement. Furthermore, the latter resulted to be an increasing function of the relative efficiency of home country's industries. One further work that studied trade agreements among asymmetric participating countries is that by Melatos and Woodland (2007). In their framework, they assumed there are three countries trading with each other in three different goods. Each country is endowed with a fixed amount of each good and, in equilibrium, it is the only exporter of only one of the goods and an importer of the other two ones. Crucially, countries are allowed to differ by preferences. Thus, in equilibrium, there are three different possible agreements among those countries: the first one is unilateral tariff setting, that is when all countries decide to stay alone and set independent trade policy settings. Secondly, the countries might choose to join preferential trade agreements; in particular, they could decide to form either custom unions, where nations set zero trade tariff within the union and a common external tariff with nonmember countries, or, alternatively, free trade areas, where members decide to set a zero trade tariff within the union and independently set tariffs outside the union. Finally, the third possible outcome is global free trade, that is a duty free world, where each country raises zero trade tariff on all the goods. Therefore, global free

trade Pareto dominates the other two solutions when all countries are similar in terms of both preferences and endowments of their respective export good. On the other side, custom unions are Pareto dominant if preferences or endowments are "sufficiently different", that is member countries have got "adjacent" preferences or endowments. Moreover, if differences in preferences or endowments are even more pronounced, free trade areas and unilateral tariff settings may also Pareto dominate global free trade (however, each of those two outcomes is never the unique equilibrium). Finally, Oladi and Beladi (2008) set up a theoretical model that supports the feasibility of global free trade. More specifically, their model features n countries all having the same preferences. Moreover, there are as many commodities as countries and goods are assumed to be imperfect substitutes. Thus, they found that splitting the world into regional blocs is not a viable solution. This is not because regional blocs can not be a welfare maximizing solution, but because such a partition is not a stable solution. In fact, they proved that member countries that maximizes their welfare are better off if they extend their free trade areas in order to include the whole globe. In particular, if the size of the trade bloc is relatively small, then as it increases slightly, the trade diversion effect is larger than the trade creation effect because many potential trading partners are left out of the bloc. Nevertheless, if the trade bloc is relatively large, as it increases by including one or more countries, the trade creation effect will dominate the trade diversion effect because a fewer countries will remain out of the bloc. Then, as the bloc tends to include all the countries, trade diversion will completely disappear. Therefore, global trade area will turn out to provide a more stable equilibrium with respect to trade blocs.

2.2 Purchasing Power Parity Theory and Pricing-to-Market

The second part of the my thesis focuses on another crucial issue in international economics, that is the Purchasing Power Parity puzzle. The latter consists in a weak connection between exchange rates and national price levels (see Obstfeld and Rogoff [2000]). Some definitions (see *Foundations of International Economics*, Obstfeld and Rogoff, The MIT Press, 1996) might be helpful to understand what is going to be argued in this section of my work. First of all, I start from the definition of the *real exchange rate* between two countries, that is the relative cost of a common reference basket of goods, where the costs of the baskets in the two countries are expressed by a common numeraire. Thus, on the one hand, according to the *Purchasing Power Parity* (or *absolute PPP*) theory, the real exchange rate is equal to one or, alternatively, tends to turn back to the unity when the long-run ration changes for some reasons:

$$\sum P_i = E \sum P_i^*,$$

where P_i is the domestic-currency price of good i, P_i^* is the foreign-curreny price, and E is the exchange rate, defined as the home-currency price. On the other hand, a weaker version of the latter hypothesis is the *relative PPP*, according to which changes in national price levels are always equal or have the tendency to be equal in the log-run:

$$\frac{\sum P_{i,t}}{\sum P_{i,t-1}} = E\frac{\sum P^*_{i,t}}{\sum P^*_{i,t-1}}.$$

Finally, an even stronger version of the absolute PPP is the *Law of One Price* (LOP), stating that if trade barriers (either natural or government imposed) are absent, any commodity would be sold for the same price everywhere:

$$P_i = EP_i^*.$$

Balassa (1964) highlighted some problems with both the absolute and the relative versions of the Purchasing Power Parity theory and, particularly, pointed to the need of general price indexes in order to evaluate properly exchange rate adjustments. So, that work argued that it is possible to observe a systematic relationship between purchasing power parities and exchange rates if non-traded goods are incorporated in the model. More specifically, it was assumed that international productivity differences in the production of traded goods are larger than productivity differences in the production of non-traded goods (i.e. services); therefore, since services affect the calculation of purchasing power parities but not the calculation of exchange rates, then the purchasing power parity between two different currencies, in terms of the currency of the relatively higher productivity country, turns out to be lower than the equilibrium exchange rate. This is because the currency of the country with higher productivity will be overvalued from the point of view of the purchasing power. Furthermore, the relationship between purchasing power parities and exchange rates can also be related to the cross-countries comparison of living standards and aggregate incomes. In particular, if per capita income differentials are seen as proxies of productivity levels differentials, then the ratio between purchasing power parity and exchange rate will result to be increasing in income levels. Samuelson (1964) reviewed and argued about some of the most important versions of the Purchasing Power Parity theory. First, he mentioned the Cassel-Ricardo Neutral-Money version of the theory, according to which money was neutral, so that the absolute level of prices were able to change without affecting price ratios in the long-run classical model. Second, he presented Keynes' definition of the PPP, that was meant as a simple theory of spatial arbitrage without considering transport costs; particularly, there were not included any arbitrage relations for wage rates or production costs. The third definition, instead, concerns costs of living: without trade costs or other barriers, foreign exchange rate is given by the ratio of costs of the same good in different currencies; the latter turns out to be equal to the ratio of

costs of living of a standard basket of goods. At this point, Samuelson objected that costs of living in different countries were calculated with different goods weighting and, moreover, transport costs and trade barriers could not be ignored. Fourth, one further definition of PPP was as ratios of export price indexes from any two countries (however, even in this case, the unequal weighting can be misleading.) Rogoff (1996) first described the major variants of PPP (Purchasing Power Parity): the law of one price (LOP), absolute and relative purchasing power parity. In more detail, about the absolute PPP, the author claimed how difficult measuring it is: first, different governments do not build indexes for an internationally common basket of goods; second, it is based on the (strong) assumption that PPP holds on average in the base year. On the other hand, turning to the relative PPP, Rogoff argued about difficulties in interpreting the value of this measure in different periods as this really relies on the base year chosen. Furthermore, the work also provided a review of some empirical evidence about the volatility of deviations from the law of one price. Particularly, it reported the main result of the comparison between international and intra-national price volatility made in Engle (1993): the relative prices of similar goods across the US and Canada are really more volatile than the relative prices of different goods within each country. The work also considered other possible sources of international divergence of prices, such as transportation costs, tariffs, nontariff barriers, information costs and pricing-to-market; in addition, there exist some particular items, such as automobiles, for which international arbitrage turns out to be really hard because of different national standards. At the end of this review, Rogoff concluded by explaining the PPP puzzle with the fact that international goods markets are not yet as integrated as the domestic ones due to significant trade barriers for several goods. Obstfeld and Rogoff (2000) addressed six of the major puzzles in international economics by introducing trade costs. One of those puzzles concerned the Purchasing Power Parity theory: in particular, the authors tried to explain the persistence of real exchange rate deviations for a range of countries, that are Canada, France, Germany, Japan and the US. More specifically, the mean half-life across real exchange rates was found equal to more than three years. First, in terms of mean reversion in shocks, they did not find much difference between prices of tradable and nontradables. This is because, as they argued, at the retail level, the distinction between the two types of goods is arbitrary and probably endogenous too: several traded goods already include many nontraded components. Second, they found further empirical support to a faster adjustment of prices to exchange rate changes for importers with respect to consumers: this is revealed by their empirical results according to which a depreciation of the exchange rate actually worsens the terms of trade, as expected by the conventional view. Third, they claimed that monopolistically supply of goods is an appealing but incomplete explanation of the persistence in international price differentials: this works for "big-ticket" commodities such as cars but not for smaller ones,

such as clothes. Then, they turned to trade costs as a more plausible rationale. In particular, they distinguished between bulk wholesale and individual consumer shipping costs: the latter ones are likely to be far larger than the former ones. Thus, they pointed out that it is fairly easy to understand why individual consumers can not arbitrage differences in prices across different countries, but it is much harder to understand what prevents arbitrage at the wholesale level. The answer they provided concerned national marketing licenses: firms can buy legal rights to control distribution of their product in one country. Furthermore, nominal rigidities (i.e. final consumer goods, both those that are domestically produced and importables result to have sticky prices in domestic currency terms) and pricing-to-market are also reported as important explanations of the PPP puzzle. Backus and Crucini (2000) aimed at shedding further light on the source of international price movements. In particular, they studied the variability of terms of trade with respect to real output and trade volumes, that is found to be largely varying over time and countries. Thus, they set up a dynamic equilibrium model of international business cycle featuring two large industrialized countries which produce imperfect substitutes using capital, labour and oil as input factors. The goods produced by the two countries are aggregated into final consumption and investment goods. Finally, there is one third country that produces oil and consumes final goods. The aim of this setting was to represent trade between large industrial countries and large non-industrial oil producers. So, they found out that the volatility and comovements of terms of trade are related to the source of shocks. More specifically, there were assumed three types of shocks: domestic productivity shock, foreign productivity shock and oil supply shock. The first two ones turned out to produce poor volatility of terms of trade: this is because the model yielded only a little variability in trade volumes. However, small shocks in oil supply resulted to generate large variation in its relative price. On the other side, movements of terms of trade and output were found to be positively correlated as long as they were both generated by productivity shocks. In turn, such correlation was negative if movements were produced by oil supply shocks: this is because, for instance, a negative shock of oil supply yields a decrease in the domestic output of industrialized countries and then an increase in the relative price of the domestic good (i.e. the terms of trade falls). Imbs, Mumtaz, Ravn and Rey (2005) addressed the PPP puzzle by focusing on the relevance of a dynamic aggregation bias. In particular, they argued and empirically (through Eurostat data) showed that a positive bias in aggregate persistence was due to the fact that the heterogeneity in price adjustments dynamics at the individual good level was not taken into account: in turn, this led to a too slow mean reversion of aggregate exchange rate. In fact, they claimed that there is no reason why every good should converge to parity homogeneously at the same time: thus, the relative price dynamics varies across goods, that can crucially differ according to, for instance, degree of tradability, degree of competition, or transportation costs. In-

deed, their result does not imply that persistence is systematically lower at the individual good level: if persistence was homogeneously lower for all individual goods, then it would result to be lower at the aggregate level too and the PPP puzzle would not exist. So, their study seemed to give an important contribution in understanding the estimated real exchange rate persistence, that had been resulting to be too high with respect theories that explained that persistence by limits to arbitrage or nominal rigidities. More generally, this work showed how important heterogeneity at the microeconomic level is in order to address macroeconomic aggregate facts. Crucini, Telmer and Zachariadis (2005) developed an empirical study on the Law-of-One-Price (LOP) theory, that states the identical goods should be priced the same in different countries, once their prices are turned into a common currency. Thus, they measured good-by-good deviations from the LOP for a really large range of goods and services across all European Union countries. Moreover, their measures are made at five-year intervals between 1975 and 1990. In more detail, they studied the cross-section distribution of the LOP deviations; the deviation of each good is meant as relative to that good's average price across the European Union. Thus, for each country they calculated the average LOP deviation across goods. They found that, after controlling for national income and Value-Added Tax, most of the means were near to zero: that meant there were around as many overpriced goods as there were underpriced goods. In addition, for each good they calculated the variance across countries. They showed, exploiting classic characteristics of the goods, that good-by-good dispersion in the absolute LOP deviations depended negatively on the tradeability of the good and positively on the share of non-traded inputs used for the production of that good. Crucini and Shintani (2008) also studied the persistence in LOP deviations through a very large international micro-price panel. Using US sectoral data, they found a positive correlation between LOP persistence and the distribution margin as expected according to the classical dichotomy: in particular, those margins included costs needed to move goods and services from the producer to the consumer plus markups over marginal costs. Furthermore, they showed that the median level of persistence across goods is low and there was no clear evidence of a border effect (the persistence of deviations across OECD countries was not that different from the persistence across US cities). In particular, they found aggregation bias on the US data but they did not find it in their international dataset: this made their results in contrast with the conclusions of Imbs et al. (2005) in that they argued that the PPP puzzle can not be generally solved by the aggregation bias. Berka and Crucini (2009) built up an alternative measure to the standard terms of trade, that is the consumption terms of trade. They criticized the models of terms of trade: first, those models normally comprise too few countries (most of the times, only two) so that one of them is likely to be large enough to affect its terms of trade. Second, those settings consider too few goods; however, including into the analysis more countries that specialize

would also mean including more goods at the same time. Finally, a large part of international trade concerns firm-to-firm or intra-firm exchanges of intermediate inputs; on the other side, consumers buy most of the items from local retailers. Thus, it could be worth to consider both producers and consumers within smaller segmented markets. So, this work developed a study about the sources of terms of trade over a panel of 38 countries in the period 1990-2005: using micro-price data from the Economist Intelligence Unit, it aimed at detecting the contributions of individual goods to the variance of the aggregate terms of trade. Specifically, the use of retail prices allowed to distinguish between relative prices of traded goods that are faced by national consumers and relative prices of the same goods that are calculated according to trade prices at the border. If producers and consumers cope with the same prices, then there is no difference between consumption and production terms of trade. In turn, in case of improvements in terms of trade, domestic producers have incentives to turn production resources into the production of exports, while domestic consumers turn consumption into the opposite direction, that is towards imports. So, they found that most of the variation of terms of trade is due to oil, automobiles and medicine; the other goods tend to be trade balanced. Furthermore, they found that consumption terms of trade at local price is more volatile than production terms of trade at world prices, even though they are correlated to each other. In particular, using retail prices to measure imports and exports made deviations from the Law of One Price affect the terms of trade. The largest contribution to the variation of terms of trade shifted from oil to medicine: this presumably came out as international deviations from LOP are larger for medicine than for oil. Berka and Devereux (2010) built up a dataset of price levels on several similar goods across several European countries over time; more specifically, data are relative to 31 countries, including both high income countries of Western Europe and emerging countries of Eastern and Southern Europe. Thus, through that data set, they measured real exchange rates at both disaggregate and aggregate level and found that the Purchasing Power Parity did not hold for any European country. In more detail, deviations from PPP turned out to be larger for non-tradable goods than for tradable ones. Furthermore, they showed that real exchange rate is significantly determined by relative GDP per capita across different countries, times and levels of aggregation. In particular, looking at disaggregated real exchange rates, they did not find much difference in terms of volatility between countries belonging to the eurozone and floating exchange rate countries. In conclusion, the set up a general equilibrium model according to which real exchange rates are determined by different growth rates between trade and non-traded sectors. Finally, results of simulations showed how that model was able to closely match the patterns of real exchange rates for most countries.

2.2.1 The Pricing-to-Market Issue

Krugman (1986) started from two empirical facts: first, movements of US import prices are not perfectly correlated with movements of exchange rates: this is to make some evidence of pricing-to-market by foreign sellers to the American market. However, pricing-to-market did not seem to hold for all commodities; instead, data on US-Germany trade revealed that PTM (Pricing-to-Market) concerned two particular industries, that were transportation equipment and machinery. Thus, Krugman considered different theoretical models, both static and dynamic, in order to explain those facts. From the static point of view, he first exploited a simple supply-and-demand model: this did not seem to provide a sufficient explanation of PTM as based on too strong assumptions, that did not match actual data. Second, he turned to a monopolistic price competition model: in order to have pricing-to-market, demand elasticity has to be increasing in the price. However, this theory did not result very convincing to the author either as it relied too much on the shape of the demand curve. Thus, he turned to an oligopoly model: firms are involved in a Cournot competition; in particular, each firm deals with a perceived demand elasticity that is equal to the ratio of the market elasticity (constant) to the firm's market share. Even in this case, the assumptions of the model were considered to be fairly unrealistic. In particular, assuming perfect substitution between goods produced by domestic and foreign firms was not as plausible as assuming domestic and foreign competitors producing differentiated products. Turning to dynamic settings, Krugman first focused on dynamics coming from the supply side: according to this approach the degree of PTM depends on both how recently the exchange rate has changed and how persistent this change is expected to be. Secondly, he asked whether a slow adjustment of the price might be due to a slow adjustment of demand to the market price. Finally, this work stressed reputation as the mechanism the rules price adjustments: thus, for example, an unexpected (and not very large) increase in marginal costs will not be straight turned into higher prices in order to not lose reputation. Krugman's conclusions were that the understanding of pricing to market mostly relied on dynamic models of imperfect competition; he particularly focused on both the role of supply dynamics (coming from the adjustment costs of distribution infrastructure related to imports) and the role of demand dynamics (coming from the firm's investments in reputation). Feenstra, Gagnon and Knetter (1996) set up a Bertrand competition model featuring differentiated products. The aim of their work was to explain why import prices do not fully respond to exchange rates, that is incomplete pass-through. The most important result was that pass-through mainly depends on the export country's market share in a particular import market. More specifically, if the market share is very high, then exporter will deal with poor competition from the other firms and will more completely pass through an exchange rate for a given demand. Thus, pass-trough resulted to be full when market share tends to the unity for a group of exporters from a given

source country. This work also includes an empirical session aiming at verifying the predictions of the theory mentioned above on a panel data set on automobile exports from the United States, Germany, France and Sweden to twelve destination countries. In summary, they found that pass-through is increasing in the market share; in particular, the larger the market share, the larger the increasing rate. Furthermore, US and German exporters pass-through a larger part of exchange rate changes with respect to French and Swedish exporters. Goldberg and Verboven (2001) studied large and persistent differences in car prices across European countries. This was an important issue even for the Commission of the European Communities that saw such price differentials as a potential danger for the effectiveness of European market integration policies. Thus, the work provided an oligopoly model featuring product differentiation. According to that a model, there are three potential sources of price differences across countries: price elasticities leading to differences in markups, costs and import quotas constraints. Turning to the empirical side of the work, the latter relied on a dataset comprising information about 150 car models (sales, list price and physical characteristics) across five markets (Belgium, France, Germany, Italy and the UK) over the period 1980-1993. So, the first source of international price differentials they analyzed concerned the demand side, that is a strong bias in consumption patterns towards domestic brands. According to their estimates, both French and British consumers regarded goods from the same country origin as closer substitute with respect to goods coming from different countries. Therefore, if, for example, the price of a French car went up, then French consumers resulted to be more likely to switch to another French car than to a foreign model. Moreover, for Italian consumers, the domestic/foreign distinction was found even stronger. However, in Germany, domestic and foreign goods belonging to the same market segment turned out to be viewed as equally substitute. Indeed, differences in prices are also reflected into cross-country differences in markups. In particular, there was found evidence of significantly larger markups in Italy with respect to the other countries. Thus, it seemed that a strong bias to domestic cars in Italy led to a high level of markup over that country. The latter was presumably because of the almost monopoly position of Fiat over the national market. The second source of cross-country price differentials considered was quota constraints, that resulted to be particularly higher in Italy and France with respect to the other three countries in the panel (this would explain such high prices of Japanese cars in those two countries). Finally, the last international prices differentials source taken into account was unobserved costs, that in empirical work were proxied by country fixed effects within the pricing equation. One further fact that this work aimed at explaining was the large year-to-year volatility, that was mostly due to the incomplete response of local currency prices to exchange rate fluctuations. Such inertia could be related to local costs for a larger part and to monopolistic price discrimination for a smaller part. Cheung, Chinn and Fujii (2001) studied

the relationship between market structure and the persistence of sectoral real exchange rates for a panel of 14 OECD countries. They pointed out that one crucial source of the real exchange rate is given by pricing-to-market, that is different pricing behaviour of firms across different countries. In particular, PTM (Pricing-to-Market) resulted to be determined by the market structure. Therefore, different degrees of market imperfections across countries and/or industries led to different degrees of real exchange rate persistence. The main result was that the more imperfect the industry market structure, the larger the tendency to pricing-to-market and, then, the slower the rate of sectoral Purchasing Power Parity reversion. Atkeson and Burstein (2008) built up a model to explain large and systematic deviations from the relative purchasing power parity (i.e. the hypothesis according to which the relative price of a trade good should stay constant over time.) So, they aimed at theoretically address to empirical facts: first, the terms of trade of manufacturing goods, defined as a country's ratio of export and import prices relative to its partners of trade, are much less volatile than the Producer Price Index-based real exchange rate for the same type of goods; second, movements in Consumer Price Index-based real exchange rates for manufacturing goods are almost as volatile as movements in Producer Price Index-based real exchange rates for manufactures. The common explanation that the authors gave to both the issues was related to pricing-to-market, that is the choice of individual producers to change the relative price of her output abroad and at home as a response to aggregate international shocks. More specifically, their model relies on two main characteristics: imperfect competition with variable markups and international trade costs (both fixed and "iceberg" costs.) Thus, firms did not result to completely pass through variations in marginal costs to prices due to the fact that markups depended on the market share. However, imperfect competition with variable markups is a necessary but not sufficient condition in order to have pricing-to-market: in fact, without any trade costs, firms have to face the same competitors both abroad and at home, so that they will have the same markups and charge and the same prices in both the markets. So, their model turned out to be able to match many relevant characteristics of international trade and market structure and, particularly, to reproduce actual deviations from the relative purchasing power parity in the US.

2.2.2 *Fixed costs of production and economies of scale*

Ethier (1982) set up a model to study the relation between the traditional national returns to scale theory, the Heckscher-Ohlin-Samuelson (H-O-S) trade model assumptions and international returns to scale. Thus, the model makes national scale economies (that are internal to individual firms), international scale economies (that are, instead, external to individual firms) and modern international trade theory's assumptions on factor endowments interact. The work reached four main results: first, international returns are

determined by the interaction between the two types of scale economies (national and international), that is also the interaction between internal and external economies relative to individual firms. Second, the work turned out to support the crucial results within the factor endowments theory even if it introduced both the two types of scale economies. Third, both intraindustry trade and interindustry trade are based on factor endowments assumptions; however, such trade resulted to be complementary to international factor mobility. Finally, the degree of intraindustry trade did not result to be crucially determined by the degree of internal scale economies and product differentiation, even though they are both very important for the theory. Indeed, a crucial role in determining economies of scale is the presence of fixed costs of production. Blanchard and Kiyotaki (1987) set a up a very famous monopolistic competition model with the aim to understand the effects of aggregate demand, that depends on real money balances, on output. The main result of that work is that monopolistic competition leads to a too low output due to aggregate demand externality. Particularly, such externality, along with small menu costs, leads to a relationship between movements in demand and output and welfare. Furthermore, if there are fixed costs, the movements in output, productivity and profitability turned out to be positively correlated. One of the implications of introducing fixed cost is the procyclical behaviour of profits: if nominal wages and prices are fixed, profit resulted to be increasing in the output. In turn, the latter result led to implications in terms of entry (consider that real money balance is measured as a ratio of nominal money to nominal wage, since the fixed markup on wages that leads to prices). In more detail, if fixed costs imply a reduction of aggregate demand, then the profits earned by all firms can be negative; moreover, imperfect competition prevents new entrants from catching all the demand by lowering prices with respect to existing firms. Therefore, very high nominal wages can stop new firms from entering the market. Hornstein (1993) extended a neoclassical growth model in order to include monopolistic competition and increasing returns to scale. More specifically, the model comprised a large number of price-setting monopolistic competitors, each of which produced an intermediate good by employing labour and capital as inputs and an increasing returns to scale technology. Furthermore, the final good was produced within a competitive industry by using those intermediate goods as inputs and a constant returns to scale technology. Finally, the final good was exploited both for consumption and investment. The intuition at the origin of this work was that the impact of a shock to aggregate fluctuations is determined not only on the magnitude of the shock, but also on the propagation mechanism. Indeed, it is reasonable that the reaction to aggregate productivity changes differ by the economic structure: thus, noncompetitive economies featuring increasing returns to scale are expected to react in a different manner with respect to competitive economies with constant returns. The main result was that introducing noncompetitive market with increasing returns to scale

yielded lower effects of productivity shocks on aggregate fluctuations. However, movements in aggregate productivity kept being really important in terms of output volatility. Rotemberg and Woodford (1993) studied the importance of taking into account imperfect competition in order to accurately measure the effects of various shocks to the economy. In particular, the reason why imperfect competition is so important is that it affects the relationship between wage and marginal product of labour. In particular, in case of imperfect competition, materials inputs determines the wedge between wage and marginal product of labour: the larger the share of material costs in the value of gross output, the larger that wedge, for a given markup. Therefore, for positive shares of material, the inefficiency wedge is larger than the individual firm's markup. Furthermore, the assumption of market power makes that of increasing returns more plausible. In terms of economies of scale, they found that zero pure profits are compatible with a wedge between marginal costs and factor prices if the average returns to scale are equal to that wedge (larger than one): intuitively, in case of increasing returns, average cost is larger than marginal cost so that price can equal average cost (and profits can be zero) even if price is larger than marginal cost. Thus, the work introduced imperfect competition of product markets into standard dynamic models of aggregate fluctuations. Devereux, Head and Lapham (1996) built up a business cycle model of monopolistic competition. There were assumed to be monopolistically competitive suppliers of intermediate goods used to produce a final good in a competitive sector. Individual producers of intermediate goods showed increasing returns to scale because of both fixed costs of production and decreasing marginal costs. Moreover, there might also be increasing returns at the aggregate level that is referred to as returns to specialization and is interpreted as a large market effect; in particular, returns to specialization existed if the final good output turned out to be positively correlated to the variety of intermediate goods produced (for a given stock of input factors). So, aggregate productivity shocks led entry and exit of firms, and returns to specialization resulted to affect aggregate fluctuations through this mechanism (that was motivated by the evidence of procyclical net business formation). The main results of this work follow. On the one hand, market power and increasing returns implied by fixed costs did not turn out to affect reactions of aggregate output to productivity shocks (with respect to standard, perfectly competitive real business cycle model). On the other hand, reactions of aggregate variables to aggregate productivity shocks resulted to be lowered by returns to specialization. Furthermore, returns to specialization and scale both seemed to be able to affect the measurement of productivity changes. More specifically, increasing returns to scale led the variance of the Solow residual to be lower than the variance of the "true" productivity shock, while returns to specialization led to the opposite bias. Thus, if both increasing returns to scale and increasing returns to specialization were considered, the variance of output turned out to be larger with respect to a standard competitive model

even though the variance of technology shocks was significantly reduced. Ciccone and Matsuyama (1999) studied the cases in which dynamic nonconvexities at the disaggregate level turn into dynamic nonconvexities at the aggregate level. They set up a model that represent an economy producing three types of goods: investment goods, consumption goods, and differentiated intermediate inputs which are allowed to vary endogenously. At each time, only a finite range of such intermediate inputs can be produced; however, that range can be increased over time by driving some units of the investment goods to start-up operations. In particular, consumption goods were produced by using both labour input and the differentiated intermediate inputs that are aggregated according to a standard CES function, so that all the intermediate inputs are involved in a symmetric manner. Moreover, also the production of investment goods employed both labour and intermediate inputs but through a different technology with respect to the production of the consumption goods. Thus, they compared equilibrium and optimal allocations in case of dynamic increasing aggregate returns that are determined by Hicks-Allen complementarities between differentiated intermediate goods. One of the main results was that return to investment is increasing with respect to the aggregate level of investment because of Hicks-Allen complementarities. Kim (2004) developed a theoretical setting that comprises four different relevant characteristics of models with scale economies, namely fixed costs, variety of products, decreasing marginal costs and market power. The work led to two major conclusions. First, if fixed costs do not vary and profits are driven to zero in every period, then the aggregate increasing returns to scale only depends on the degree of returns to variety. This is due to endogeneity of the number of firms, that is determined by a mechanism of entry and exit: movements in the number of firms can be regarded as movements in productivity in reaction to exogenous shocks to inputs. Secondly, if fixed costs are allowed to react to changes in aggregate activity or the zero-profit condition does not hold in the short-run, then aggregate returns to scale turned out to be determined by product variety, diminishing marginal costs and market power. In particular, when there is no period-by-period adjustment, the only determinant of the degree of returns to scale resulted to be the degree of market power. However, independently of assumptions about adjustments, the degree of market power did not turn out to determine input prices, that are crucial to lead to the uniqueness of equilibrium: in fact, movements in input prices are determined by movements in gross output rather than in net output, because fixed costs and the number of firms are exogenous with respect to the firm's choice about inputs.

2.2.3 The home bias effect

Indeed, international trade patterns (and prices) resulted to be also affected by the home bias effect. One of the major works about this is Krugman (1980). The latter is a monopolistic competition model with free entry (i.e. monopoly profits are driven to zero). The

main result was that if there are two monopolistically competitive economies, increasing returns yield gains from trade between them even if they are homogeneous by tastes, technology and input factors endowment. In particular, this work focused on the home market effect, according to which, in presence of increasing returns, countries will be more keen to export those goods for which they have relatively larger markets. Thus, the larger the trade costs, the larger the taste specialization and, finally, the larger the scale economies (meant as the ratio between fixed costs and variable costs of production), the larger the specialization in the production of one particular good: in turn, this specialization increases the opportunity to become a net-exporter of that good. In more detail, because of transport costs, wages might result to be different across countries. Workers will be better off in larger economies where they earn larger wages. However, if production costs are the same, it is more profitable to produce within the relatively larger market in order to minimize transportation costs; wage differentials must compensate such an advantage in order to keep employment in both the countries. Furthermore, the degree in production specialization depends on the degree in tastes: the more dissimilar tastes across countries, the larger the opportunity to specialize. Thus, if two countries differ by tastes, they will choose to specialize in the production of that good for which they have a larger domestic market. Indeed, the more important economies of scale and the less important transportation costs, the lower the opportunity of incomplete specialization. Hillberry and Hummels (2002) studied the relationship between the home bias effect and the co-location decisions of both intermediate and final goods producers. In their model, consumers have identical preferences: in particular, they are of Cobb-Douglas type over different commodities and Dixit-Stiglitz type over differentiated varieties within the same commodity group. Moreover, differentiated goods are produced by firms using intermediate inputs, capital and labour and can be used to produce final goods, intermediate goods or both. Labour and capital are assumed to be mobile across sectors within the same region but segmented at the region level. Finally, small trade costs imply co-location between producers of intermediate goods and producers of final goods: industrial demands turned out to be more oriented towards goods that are locally available because firms move in order to minimize trade costs. Therefore, demand resulted to be endogenously home biased in general equilibrium. The model was empirically tested on commodity-level data drawn from the 1997 US Commodity Flow Survey; particularly, the dataset matched the detailed regional geography of shipments to the features of the shipping establishments. The main results of their empirical analysis are following. First, regional absorption of goods resulted to vary over space depending on the location of final goods production. Second, the more local the production of a good, the larger the absorption of that good. Third, within a narrow industrial classification, the characteristics of shipments turned out to vary over space: goods at the first steps of the value chain travelled short distances while goods at the last

steps of the value chain travelled longer distances. Moreover, goods at the late stage also resulted to be more likely to cross national borders. Fourth, trade barriers were found to vary significantly over goods. Finally, it was found no evidence that the increasing effect of trade barriers disappeared if production location was controlled for (this result was probably due to the fact the goods classification system used was not enough detailed to capture intermediate-final goods relationships that might occur for really specific products). Hanson and Xiang (2004) built up and estimated a model aiming at studying variation of home-market effects across different industries. On the theoretical side, they developed a monopolistic competition model of international trade. There were assumed to be two countries, one large and one small, each of which has one input factor, that is labour. Moreover, there was a continuum of monopolistically competitive industries. Consumers had the same Cobb-Douglas preferences over products of all industries. Industries were allowed to differ by the number of varieties, elasticity of substitution between varieties and iceberg transport costs. Furthermore, there was assumed no international specialization at the industry level. The main implication of such a model was that the home-market effects depends on the number of industries with differentiated products within the whole economy. On the one hand, in case of such industries, those industries with larger transport costs and lower substitution elasticity will tend to concentrate more within the large country with respect to those industries featuring lower transport costs and larger substitution elasticity. This occurs because moving production from the small country to the large one yields larger savings in terms of trade costs and lower increases in production costs for high transport/low demand elasticity firms. On the other hand, in an economy with only two industries, industries with high transport cost and lower demand elasticity will concentrate within the large country in absolute and not in just relative terms. On the empirical side, this work employed a "difference-in-difference" gravity specification in order to test the predictions of the theoretical model. That is a three-stage approach: first, they selected pairs of countries coping with common trade barriers in their export destination markets; second, they selected two groups of industries, one with high transport costs and low demand elasticity (the "treatment" subsample) and one with low transport cost and high demand elasticity (the "control" subsample); third, they tested whether larger countries resulted to have larger exports of relatively higher transport cost and more differentiated goods. Thus, the "difference-in-difference" estimation methods led to correct both the bias depending on bilateral exports determinants that are specific to the importer country (such as import tariffs, import-country remoteness, home bias in demand) and the bias depending on the large country's tendency to export more of all goods. In particular, the first difference tackled the former bias while the second difference aimed at eliminating the latter one. Therefore, empirical results confirmed that international trade is affected by imperfect competition and increasing returns to scale

effect and, particularly, that country size is relevant for industrial specialization. Lopez, Pagoulatos, Gonzalez (2006) measured the degree of home bias for processed food and beverage products within the US and showed some of its determinants. Within this scope, they exploited an Armington model that is based on product differentiation by country of origin. The motivation of this work was given by the small import shares within the US food-processing sector even though trade barriers were fairly low. Thus, one possible explanation for such evidence was the "home bias", that worked as a natural barrier to imports. As also showed in other studies developed in many countries /industries, the work provided evidence of strong "home bias" that significantly prevented foreign import from entering the US domestic market; furthermore, they showed that imports levels, on average, would be nine times as large as the actual ones if the home bias did not exist. Turning to some details, the level of home bias in the US food-processing industry resulted to be related to raw agricultural sector, finished rather than intermediate goods, imports from neighboring markets, such as Canada and Mexico and industries with non-tariff barriers. Therefore, the main conclusion is that the home bias is not only determined by the supply side (such as had been showed through gravity models) but also by demand preferences. So, an eventual model aiming at providing a complete explanation of home bias should include aspects related to both the sides (supply an demand). If previous works had mostly focused on trade barriers, transport costs and income changes as determinants of trade growth, Whalley and Xin (2007) turned the attention on preferences. More specifically, they set up a global numerical general equilibrium model in order to measure the effects of changes in home bias within regions on the worldwide trade growth over the last decades (data referred to the period 1975-2004). They found that changes in home product preferences over the period considered could have led to a reduction in global trade by 27 percent with respect to 2004 levels. In more detail, larger effects (19 percent) came from home bias changes in developing countries with respect to effects (8 percent) from the developed countries. These results seemed to be indicating the growing importance of regionalization within the global economy, probably due to an increase in the number of trade agreements. In order to develop the quantitative analysis, they set up and calibrated a simple international trade model of inter bloc trade. Further results concerned some other sources of the growth of international trade: in particular, income growth, income convergence and decreasing trade costs resulted to account for, respectively, 76 percent, 4 percent and 7 percent of the growth rate. Finally, the work raised one further issue (to be addresses in future works) about an eventual regionalization within the trade blocs themselves. Mylonidis (2008) studied the relationship between home bias towards domestic tradable goods and deviations from absolute PPP. Within this scope, the work provided a simple theoretical framework modeling a two-country (home and foreign country) economy. In particular, the model featured infinitely living consumers

whose behaviour follows the permanent income hypothesis. Moreover, both domestic and foreign consumers are assumed to buy two types of traded goods: a domestically produced good and a foreign produced good. Empirically, the "home" country is a pool of countries (Germany, Japan, France, Italy, Canada and the UK) while the "foreign" country is the US. In addition, data on bilateral nominal exchange rates against the US dollar and the producer price index (that is preferred to the consumer price index as it includes largely tradable goods) are drawn from the International Financial Statistics database. Thus, the main result from the empirical analysis was that the home bias can explain a large part of the PPP deviations. Balta and Delgado (2009) explored the home market bias within the European Union. The main aim of this work is to assess whether the integration policies within the Union had been successful or not by observing the level and the over time pattern of home bias across the European countries in goods and services and in equity portfolio holdings. Indeed, a large level of integration of goods and capital markets was thought of as necessary in order to tackle asymmetric shocks, particularly in the euro area. That was because exchange rates and interest rates had turned to be managed at central common level. Thus, in order to develop the analysis of home bias, first a "Frictionless Economy" scenario was built up: that is a market where all countries' production is pooled so that consumers randomly take products from that pool (the share of a country in each consumption basket was assumed to depend on the relative share of that country in the pooled production). So, the first result is that the policies aimed at building up the Single Market did not result to be so effective as long as all the EU-15 countries turned out to consume home products and invest in home equity largely more than in the benchmark scenario. Furthermore, with respect to their economic size, EU-15 countries were more home biased than Japan and the US. Turning to the second result, in terms of over time pattern of home bias, the latter resulted to be stuck at the same level since 2000 for goods and services, while it decreased for equity markets. Third, a significant difference in the level of home bias was found across the EU countries. Specifically, there are some countries, such as the Netherlands, Belgium, Austria and Germany, that seemed to be integrated, while there are other countries, such as Greece and Spain, whose demand resulted much less oriented to foreign products and equity. Moreover, the new EU member states turned out to be close to the EU-15 countries in terms of home bias in products, even though their equity portfolios seemed to be strongly home-biased.

2.2.4 *Heterogeneity in tastes*

I now turn to another issue that is related to the home market effect and concerns how much different tastes are across countries and, particularly, what determines them. Roy and Viaene (1998) set up a Ricardian model featuring country bias in consumer preferences, but neither market imperfections nor economies of scale. More specifically, identical

physical goods can be perceived as different by consumers as they are manufactured in different countries. Such a perception might be due to different factors, like the reputation of quality of goods produced in some particular countries, information and beliefs on the production process in other countries, considerations of noneconomic nature related to social or political bias. As an example, you might think of the case that production leads to less environmental damages in some countries than in others (this might be due to differences in the abatement capacity of the ecosystem). If consumers are concerned for the health of the global environment for not really large price differentials, they will chose to buy from those countries where the environmental damage is relatively lower. So, the first contribution of this work is that production specialization across countries can be affected by the preference structure. Differently from what predicted by the classical Ricardian model, this model implies some equilibria in which specialization in production is incomplete across the two countries that, consequently, trade all the commodities in the economy; furthermore, in other possible equilibria, specialization and trade follow reverse patterns from those predicted within the Ricardian world. The second major result of this paper is that both interindustry and intraindustry forms of trade can happen at the same time despite of the absence of market imperfections, strategic behaviours or product differentiation. Akerlof and Kranton (2000) studied the effect of identity on economic outputs. So, they included identity within a model of behaviour; in particular, they analyzed different examples of behaviours that are related to identity, such as gender discrimination in the labour market, the household division of labour and the economic mechanics of social exclusion and poverty. So doing, they reached conclusions that differ from what predicted by previous economic models about. The first result was that people take identity-based payoffs from their own actions. This could explain bahaviours that might seem detrimental or even self-destructive from people with different identities; however, those behaviours could be determined by the willing to enhance the sense of self or to keep self-image high. In fact, focusing on the gender discrimination within the workplace, they found that a lower utility for women working in a "man's" job: this, of course, turned out to affect the labour supply. Secondly, the work showed that people take identity-based payoffs also from others' actions. So, identity could also have an externality effect as what one person does might affect behaviours of others. As an example, they used the dress as a symbol of femininity: therefore, if a man wore a dress, he would threaten other men's identity. Third, third parties can produce persistence changes in people's payoffs. Preferences can change over the whole society and, particularly, they can be manipulated from someone that has incentives to do that (see advertisements or public policies). In their poverty model, the larger the extent of social exclusion, the more the chances that people avoid remunerative actions. Finally, some people might choose an identity that might be forbidden for others. Thus, individuals might be willing to choose a type of identity

but limits to that choice might also be crucial to an individual's well-being in economic terms. In particular, changes in social categories and behavioural prescriptions could affect identity-based payoffs: this turned out to be really important when they focused on social exclusion. Francois and Ypersele (2002) gave the definition of cultural goods as those goods that domestic consumers value in a different manner with respect to foreigners and that are produced by increasing returns to scale technologies. A real case reported in this work is that of Hollywood movies that, according to the popular press, were threatening traditional cultures within European countries. In fact, exploiting characteristics that are appreciated in different countries, Hollywood films could crowd out European competitors that would not be able to compete internationally by their domestic-oriented products. Thus, they set up a theoretical model in order to find out those conditions that make the imposition of a tariff on the homogeneosuly valued goods Pareto improving. In more detail, the model assumed an economy with two countries (say France and the US) and three goods. In one of the two countries, the US, there are two potential producers: one produces a homogeneously valued good across the two countries, while the other one produces a good that is internationally valued in a heterogeneous manner. In the other country, say France, there is only one producer that produces a good that has got different values in the two countries and, particularly, has got no value for American consumers. So, as an example, the work led to the conclusion that a tariff on the import of films from Hollywood to France can actually be welfare improving for both the countries. Giannetti and Yafeh (2008) focused on the effects of cultural differences within financial markets. In particular, they empirically studied, through a large dataset of international syndicated bank loans, whether such differences between professional decision-makers are able to affect financial contracts. In terms of results, they first found that decision-makers are keen to give better contractual conditions and share risk with counterparties that result to be more alike. In more detail, cultural differences turned out to prevent lead banks from lending a certain amount of funds to borrowers and participant banks from investing in the syndicate. Thus, on the one hand, lead banks resulted to concede lower amounts of loans at a higher interest rate to borrowers that were more culturally distant; moreover, the larger the cultural gap with borrowers, the larger the probability that those banks required third-party guarantees. On the other hand, participant banks turned out to fund syndicated loans from culturally distant banks for lower portions. Furthermore, cultural similarity seemed to matter both in debt markets and in equity markets. Finally, cultural biases did not result to be significantly decreased after repeated interactions with the same counterpart or with other foreign agents. Olivier, Thoenig and Verdier (2008) developed a model aimed at examining the relationship between international trade and the dynamics of cultural identity. So, in their model, they included a cultural good, that was meant as a positive group externality among individuals having the same culture

and the same consumption patterns of that particular good. There were assumed two types of agents: standard *homo economicus*, whose preferences over all goods (included the cultural good) are well defined and who does not benefit from the group externality, and *homo culturalis*, who benefits from both individual consumption and positive group externality (and, consequently, pays a premium for the cultural good). Furthermore, the share of agents that benefit from the group externality related to the cultural good is endogenous and depends on a dynamic process of parental and peer socialization. Thus, the relationship between cultural identity and market equilibrium is twofold. On the one hand, cultural identity affected both prices and the allocation of resources through the standard demand channel: the lager the size of a given cultural community, the larger the demand for the relative cultural good, the larger the price of that good in equilibrium (reciprocally, the larger the price of the cultural good, the lower the utility of consuming that good). On the other hand, there is also a cultural identity effect leading to cultural homogenization over the society. The consequence of this interaction between cultural identity and economic equilibrium is that preferences are endogenous and are dependent on the supply side of the economy (i.e. factor endowments and technology). Thus, the work studied the effect of three types of trade integration on cultural identity. In the first case, they focused on the integration of standard goods markets. Indeed, this type of trade is worth for consumers of those goods, but it is costly for proponents of cultural goods that are substitute to standard goods. Therefore, trade openness increases cultural divergence across the world. In the second case, the work turned to the effects of trade of cultural goods. Particularly, there was a distinction between local cultural goods (that can be only produced and consumed locally) and global cultural goods (that, instead, can be produced and consumed everywhere). So, they found that the local culture of the country with comparative advantage in the global cultural good will result to be expanded; on the other side, the local culture of the other country will face an erosion process. Finally, the attention is turned to virtual integration, that means socialization across heterogeneous groups through, for example, migration, student exchanges or tourism. Of course, socialization of individuals from different countries occurs only if they are sensitive to the global culture: therefore, in this case, integration led to the erosion of the local cultures and homogenization of tastes across the countries. Auer (2009) focused on a two-sided heterogeneity: on the one hand, products are heterogeneous in their attributes; on the other hand, consumers are heterogeneous in their taste for those attributes of products. So, this theoretical work led to an equilibrium that matches consumer valuations with good attributes; in particular, the model extended Krugman (1980) by introducing product and taste heterogeneity. The first result of the model is a within-industry generalization of the home market effect studied by Krugman: each country's industry is oriented to the tastes of local population. If, taking the car industry as an example, French consumers focus

more on fuel efficiency, while German consumers on top-speed, then it results that France will become a net exporter of fuel efficient cars, while Germany will become a net exporter of fast cars. However, none of them will become a net exporter of cars. The second result of the model is that, in the short run, consumption turned out to be home biased after trade liberalization: this means that the volume of trade was found lower than expected according to transportation costs and demand elasticity. Thus, taste differences across countries resulted to be a limit to international trade. The third result of this paper is that, in the long run, the within industry market effect increases as countries specialize even more while the home bias disappears: therefore, the long-run volume of trade turned out be the same as in the case of no taste differences across countries. The latter means that Linder's (1961) theory according to which taste heterogeneity across countries is an impediment to international trade only in the short-run.

2.2.5 *The role of trade costs in international pricing*

Samuelson (1954) studied the effects of different types of trade impediments by a simple two-country two-good model. The first type of impediment is given by real transport costs, that are defined in a manner that will become famous in the modern literature on international trade. The idea was that part of the value of the good shipped abroad is consumed during the act of shipment. So, these impediments were thought of as "real" as they implied the use of resources in shipping goods. As an example, the author used ice: only a part of ice exported to another country will arrive at destination as unmelted ice; the other part will be melted away. Thus, this type of trade costs will take the name of "iceberg costs". By comparing the balances of payments of the two countries in the model, it resulted that goods are cheapest in their origin country because over there both transport costs on the export good and trade costs on the import good are saved. The other trade impediments considered in this work are of artificial type and are given by tariffs or quotas. In order to make artificial impediments comparable with the real one previously described, it was assumed that US Customs Service taxed imported goods in the form of part of those imported goods themselves. In terms of international prices consequences, artificial impediments led to the same implications as real impediments: goods resulted to be cheapest in the origin country. However, balance of payments in the two countries turned out to be affected by this type of trade impediments in a way that was different from the former one. This happened because the government was assumed to distribute tariff receipts to the representative consumer in lump-sum manner. Therefore, consumers can think of the true import prices for them as equal to the actual domestic prices. For example, imports valued inside the US were equal to exports valued in the US plus a lump-sum tariff rebate.

Anderson and van Wincoop (2003) aimed at providing gravity equations with a the-

oretical foundation. This was to yield consistent and efficient estimates of theoretical gravity equations by considering and correcting the omitted variable bias and, moreover, to correctly measure the impact of trade frictions through comparative statics. So, they set up a model featuring multiple regions and multiple differentiated goods. In particular, each region was assumed to be specialized in the production of one good and the total supply of each good was fixed. Furthermore, in every region, consumers maximize a CES function that aggregates goods coming from all the regions and also includes a distribution parameter. In this model, prices were allowed to differ across destinations because of trade costs, that arose from the exporter side. Aggregate price indexes turned out to be "multilateral resistance" variables as determined by all bilateral resistances within the economy. Trade costs are thought of as information costs, legal and regulatory costs and transport costs. In more detail, the trade barrier between any pair of regions were split into three components: the bilateral trade barrier between the two regions themselves and each region specific resistance to trade to all regions. Thus, bilateral trade was determined by relative trade barriers, that is the bilateral trade barriers relative to average trade barriers that each of the two regions have to face with all trading partners. The three main comparative statics implications from this framework, in terms of effects of a uniform increase of national border barriers across all countries, follows. First, relative trade barriers increased less for small countries, so yielding to a lower reduction in bilateral trade. This was because multilateral trade resistance increased more for small countries than for big countries. Second, the increase in trade within small countries resulted to be larger than the increase of trade within large countries. Third, once size was controlled for, trade within country, say, 1 increased relative to trade between country 1 and country, say, 2: the smaller country 1, the larger country 2, the larger such an increase came up. Thus, empirically they exploited this framework in order to address the McCallum puzzle and found that national border made trade between industrialized countries fall by a 20-50 percent. Burstein, Neves and Rebelo (2003) studied the relationship between distribution costs and the behaviour of real exchange rate during exchange rate-based stabilization. The major aim was to explain how come that a large part of the movements in the US real exchange rate had resulted to be due to movements in the prices of tradable goods (see Engel [1999]). In fact, standard real exchange models assumed the purchasing power parity to hold for tradable goods, so that deviations from the PPP only depended on prices of non-tradable goods. So, they first showed really large extent of distribution costs for the average consumer good: it amounted to around 40 percent of the retail price in the US and 60 percent of the retail price in Argentina. Then, they set up a model in which no good is traded for free. More specifically, all goods need distribution services (such as wholesale and retail services, marketing and advertisement and local transportation services) that are intensive in local labour and land, so that they

can not be traded. Thus, because those distribution services are non-tradable and then country specific, they contribute to generate price differentials for traded goods across countries. Therefore, non-tradable goods are included into the standard theory of PPP in the form of distribution costs: if the latter are zero, then the standard PPP results to be holding again. On the other side, the larger the distribution margin across the economy (defined as the gap between retail price and producer price), the larger the fraction of RER due to fluctuations of prices of tradable goods. Finally, in calibration exercises, the model employed seemed to be able to generate large RER appreciations. Anderson and van Wincoop (2004) surveyed different measures of trade costs. In a broad way, trade costs are those costs faced to ship a good to the final consumer. Some examples follow: transportation costs (concerning both freight and time), policy barriers (of both tariff and non-tariff types), cost of switching from one currency to another one, information costs, security costs, contracts enforcement costs, legal costs, wholesale and retail distribution costs. They resulted to be really large particularly in the industrialized countries (according to an estimate of the tax equivalent of representative trade costs, they accounted to 170 percent). Furthermore, they also showed to be very variable across both goods and countries. This work provided evidence of three types of trade costs, that are international policy barriers, transport costs and distribution costs, and argued about relative measurements problems and limitations. The major data source for international policy barriers to trade is the United Nations Conference on Trade and Development's Trade Analysis & Information System (TRAINS). The main limitation of that database is that it does not provide ad valorem equivalents of specific tariffs: this turns out to be a problem especially for those industries where specific tariffs are common (see agriculture in many countries). In terms of evidence, tariffs resulted to be fairly low (less than 5 percent) in developed countries and higher (more than 10 percent) in developing countries. In addition, dispersion across countries is also large: tariffs go from 0 percent (in Switzerland) to 30.1 percent (in India); in the US tariffs amount to 1.9 percent. Turning to non-tariff barriers, they can be defined in both a narrow and a broad way: the narrow definition includes control measures on price, quantity and quality; the broad definition, instead, includes the former plus antidumping measures. However, in this case, data limitations are even stronger in this case as the number of countries for which information are available is lower than in case of tariff barriers. For the US, the trade-weighted NTB (Non-Tariff Barriers) coverage is much larger than the arithmetic NTB coverage: this proved that NTB mostly affect traded goods. Finally, NTB's seem to be more concentrated in a low number of industries: in particular, textiles/apparel, wood and wood products, plus some other manufacturing industries. About transport costs, these can be of two major types: direct costs (such as freight charges and insurance related to freight charges) and indirect costs (such as holding cost for goods in transit, inventory costs and shipment preparation costs). The latter need

to be inferred; the former ones, instead, can be drawn from different sources, such as the US Census and the IMF. The trade-weighted average trade cost ranges from 3.8 percent of the f.o.b. price in the US to 13.3 percent in Paraguay. Moreover, across commodities in the US. the arithmetic averages are included between 5.7 percent (for machinery and transport equipment) and 15.7 percent (for mineral fuels). Finally, wholesale and retail distribution costs are included in retail prices and vary across countries. As in Burstein, Neves and Rebelo (2003), domestic distribution costs can be constructed using national input-output data for tradable consumption goods. Thus, the average distribution costs range from 42 percent in Belgium to 70 percent in Japan (in the US they account to 68 percent of producer price); they vary even more across goods: in particular, in the US, they range from 14 percent on electronic equipment to 216 percent on ladies clothing. Arkolakis (2008) set up a monopolistic competition model with product differentiation and productivity heterogeneity. The aim of their work is to shed light on market penetration costs that are thought of as marketing costs. The latter were assumed to have two main features: fist, the larger the population size of a market, the lower the cost of selling goods to a given number of consumers within that market (in fact, some evidence is provided about how cost of advertising varies by population size); secondly, the larger the number of consumers reached, the larger marginal cost of marketing, that means that a firm entering into the market is going to cope with increasing marginal costs in order to reach additional consumers (even in this case, evidence of decreasing returns to scale of advertising costs within a certain market was reported). In terms of results, first the work explained the existence of many small exporters in exporting destinations as showed in the past literature (see Eaton, Kortum and Kramarz [2008]). The uniform fixed cost models (see Melitz [2003]) implied large fixed costs at the entry but, so doing, they were not able to explain why there were so many small exporters. Thus, in larger market reaching the first consumers implied a relatively lower cost due to the increasing returns to scale of adverting with respect the population dimension; moreover, the increasing marginal costs of marketing implied that the less productive firms could reach only a few consumers and, then, export only a little amounts. Moreover, this work, through comparative statics, also showed a large increase of trade volumes after trade liberalization for those goods with low trade volumes before such liberalization. Empirically, the increase in the trade of such goods between the US and Mexico after the NAFTA liberalization in the 90s' seemed to match well the theoretical conclusions of the model. Helpman, Melitz and Rubistein (2008) set up a model able to catch two important characteristics of international trade: first, zero trade flows between many pairs of countries; second, the varying number of exporting firms across destination countries. They provided evidence that, on a panel of 158 countries, the largest share of country pairs did not trade with each other, while the lowest share of country pairs traded in both directions (the middle share, instead, traded

in only one direction). Then, crucially, trade barriers could affect trade through two separate channels: the intensive margin, that is the trade volume for each exporter, and the extensive margin, the number of exporters. In order to separate those two channels in the empirical analysis of international trade, the work relied on a international trade model featuring heterogeneous firms and yielding a gravity equation that takes into account the self-selection of firms into export and the effect on trade volumes. Producers willing to export were assumed to deal with two additional costs, that were a transport cost and a fixed cost of exporting to a specific country. Particularly, those additional costs were not assumed to depend on the identity (productivity) of exporting producers but on the identity of origin and destination countries. Thus, empirically, they exploited a two-stage estimation procedure: it employed, in the first stage, an equation aimed at selecting trading partners, while, in the second stage, a trade flow equation. In more detail, the second stage equation addressed two sources of bias related to standard gravity equations: a selection bias and an unobserved heterogeneity bias, that came from heterogeneity in the share of firms exporting from a source to a destination national market. So, it turned out that estimates of the impact of trade barriers by a standard gravity equation were biased upward: higher trade volumes did not result to depend only on lower trade barriers, but also on a larger number of exporters to a specific destination country. In fact, the fixed costs of trade turned out to be reduced by sharing a common language or religion or by joining the same Free Trade Area with the trade partner: indeed, those common elements did not affect the export volumes but only an exporter's choice of the destination country. In addition, asymmetries in bilateral trade flows resulted to also depend on asymmetries in extensive margins; in turn, the latter asymmetries depended on fixed trade costs heterogeneity. Corsetti and Dedola (2005) set up a two-country model of real and monetary transmission in case of international price discrimination. In this work, upstream monopolistic firms sell tradable goods to competitive retailers that are located in different places. Such vertical interaction between monopolistic producers and local retailers, that leads to market segmentation, is exploited to study the implications of distributive trade on the level of exchange rate pass-through into import prices. In particular, the elasticity of demand for the same good turns out to differ across markets due to the fact that distribution services are intensive in local nontraded inputs. Thus, the main implications from the model follow. First, optimal pricing by monopolistic firms lead to endogenous deviations from the law of one price at both the wholesale and the retail level (notice that in setting optimal prices, it must hold the constraint that does not allow for opportunities of arbitrage across wholesalers and retailers placed in different markets). Second, optimal price discrimination across national borders leads to incomplete exchange rate pass-through into import prices. Finally, nominal depreciations have a negative effect in terms of terms of trade (however, the more firms can set prices independently of exchange

rates fluctuations, the lower the impact of such fluctuations on relative international prices of domestic and foreign goods). In conclusion, according to this model, large movements in the nominal and real exchange rates (positively correlated) turn into small movements in price levels, consumption and employment in equilibrium: thus, fluctuations in nominal and real exchange rates are more volatile that fluctuations in fundamentals. Finally, some criticism to iceberg costs was made by McCann (2005), that reviewed some properties of those costs in order to show the implications for new economic geography models. The work first described the Samuelson iceberg transport cost function. According to the latter, transportation costs impose a step-wise discontinuity for the home and foreign prices of the same goods. In particular, the extent of such discontinuity depends on the percentage of the value of the good that is consumed by during the shipment. That percentage is actually used to represent transport costs: the larger it is, the larger the discontinuity between home and foreign prices. It was highlighted that discontinuity does not depend on any geographical features: spatial pricing results to be not related to distance at all. Then, the paper turns to the new definition of iceberg costs by P. Krugman (1991), that explicitly related those costs to geographical distance. Krugman iceberg costs have three main properties. First, they are convex with respect to distance, that is the absolute quantity of the shipped good's value that is consumed for each kilometer of the shipment falls as the distance to be covered increases. Second, the degree of convexity increases with the original value of the good that is being shipped: the larger the original value, the larger the rate at which the delivered price grows with distance. Third, the transport cost per ton-kilometre does not depend on the total quantity shipped. Next, the work presented a broader definition of iceberg costs that was considered necessary in order to bridge the gap between new economic geography models and empirical gravity models: more specifically, this larger definition should also include information costs, institutional barriers, linguistic differences as well as quality standards. Finally, it is concluded that iceberg costs assumptions are always problematic as an empirical evaluation of them is something hard to do. Thus, as long as these costs are crucial within many important models, it is necessary to be cautious when moving from those models to reality or policy implications.

2.3 Summary of the literature review

2.3.1 Economic integration: is it always efficient?

- *Productivity heterogeneity and trade.* Melitz (2003) explained welfare gains from international trade through intra-industry reallocation: the most efficient firms increase their market shares and profits, while the least productive agents are pushed off the market. Bernard and Jensen (1999), Aw, Chung and Roberts (2000) and

Pavnik (2002) provided evidence of the learning-by-doing hypothesis, according to which exporting boosts firms' performances and productivities for, respectively, the US, Taiwan and Chile.

- *Trade, market size and competition toughness.* Melitz and Ottaviano (2008) theoretically showed that bigger markets have a larger number of competitors and a higher level of product variety; therefore, international trade turned out to have pro-competitive effects due to the reduction of markups and, then, prices. Empirical evidence of such an effect is reported in Campbell and Hopenhayn (2005) and Chen, Imbs and Scott (2009) for, respectively, the US and the EU.

- *Efficiency of input factors allocation.* Epifani and Gancia (2011) showed that asymmetric exposure to international trade can contribute to markup heterogeneity across industries; in turn, this leads to intersectoral misallocation of production factors. On the empirical side, Hsieh and Klenow (2009) revealed that input factor misallocation can explain the lower aggregate total factor productivity in China and India with respect to the US.

- *Different sources of market power.* The degree of market competition toughness can be determined by different sources: horizontal product differentiation across firms (Dixit and Stiglitz, 1977); the number of competitors (Dunne, Klimek, Roberts and Xu, 2009); preference for variety (Bilbiie, Ghironi and Melitz, 2007; Epifani and Gancia, 2011); producers' clusters, geographic segmentation and transport costs (Syverson, 2004); institutional factors, such as barriers to entry, price controls, operational restrictions, public sector size (Hopenhayn, 1992; Aghion, Harris, Howitt and Vickers, 2001; Ryan, 2006).

- *Some issues concerning economic integration and fiscal competition.* Cremer and Pestieau (1996) and Bolton and Gerard (1997) pointed out that it is important to make preferences over fiscal policies across the EU members more homogeneous in order to minimize the costs of integration. Thus, reducing income distribution differences as well as enhancing labour (and capital) mobility (see Hindrinks, 2001 and Kesslerm Lulfesmann and Myers, 2002) turned out to be crucial in order to achieve that target.

- *Constitution and efficiency of trade blocs.* Krugman (1989) showed that the constitution of trade blocs, defined as areas with internal free trade and a common external ad valorem tariff can reduce the interbloc trade and decrease the world welfare. However, as argued in Krugman (1991) and Frankel, Stein and Wei (1996), in case of prohibitive trade costs, the formation of continental ("natural") blocs is optimal. Bond and Park (2002) and Fung and Schneider (2005) dealt with trade

agreements between small and large countries ("new regionalism"): in particular, the first work studied how to exploit variations of payoffs over time in order to relax only one country's incentive constraints in trade agreements.

2.3.2 Purchasing Power Parity theory and Pricing-to-Market

- *The PPP puzzle.* Balassa (1964) argued that it is possible to observe a systematic relationship between purchasing power parities and exchange rates if non-traded goods are considered. International productivity differences in the production of traded goods are larger than productivity differences in the production of non-traded goods (services): the latter affect the calculation of purchasing power parities but not the calculation of exchange rates. Rogoff (1996) and Obstfeld and Rogoff (2000) considered some possible sources of international divergence of prices, such as transportation costs, tariff and non-tariff barriers, information costs, different national quality standards, nominal rigidities and pricing-to-market. Crucini, Telmer and Zachariadis (2005) and Crucini and Shintani (2008) empirically found a negative correlation between Law of One Price deviations and tradeability of goods for, respectively, the EU and the US.

- *The PTM issue.* Krugman (1986) theoretically pointed out that the understanding of pricing-to-market mostly relies on dynamic models of imperfect competition. Feenstra, Gagnon and Knetter (1996), Goldberg and Verboven (2001) and Cheung, Chinn and Fujii (2001) found empirical evidence that PTM is determined by the market structure. Finally, Atkeson and Burstein (2008) explained PTM by both imperfect competition and international trade costs.

- *The home bias effect.* Krugman (1980) studied the home market effect, according to which, in presence of increasing returns, countries will be more keen to export those goods for which they have relatively larger markets. More recently, Hanson and Xiang (2004) showed that industries with larger transport costs and lower substitution elasticities tend to concentrate within larger countries with respect to industries with lower transport costs and larger substitution elasticities. Lopez, Pagoulatos and Gonzalez (2006) and Balta and Delgado (2009) provided evidence of the home bias effect in, respectively, the US and the EU.

- *Heterogeneity in tastes.* Roy and Viaene (1998) pointed out that the same goods can be perceived differently according to the origin country, because of reputation of quality, beliefs on the production process and political/social bias. Akerlof and Kranton (2000) studied identity-based economic payoffs that people take from their own actions or from others' actions. Francois and Ypersele (2002) and Olivier, Thoening and Verdier (2008) defined the cultural goods: the first as goods that

domestic consumers value in a different manner with respect to foreigners; the second as positive group externality among individuals sharing the same culture and the same consumption patterns on a particular goods.

- *The role of trade costs.* Anderson and van Wincoop (2004) surveyed different measures of trade costs: transport costs, policy barriers (of both tariff and non-tariff types), cost of switching from one currency to another one, information costs, security costs, contract enforcement costs, wholesale and distribution costs. Moreover, they showed how trade costs can vary across both countries and goods. Helpman, Melitz and Rubinstein (2008) set up a model that catches two important features of international trade: first, zero trade flows between many pairs of countries; second, the varying number of exporting firms across destination countries. In particular, they showed that trade barriers can affect trade through two different channels: the intensive margin, that is the volume for each exporter, and the extensive margin, that is the number of exporters.

3 Industrial Structure, Trade and Regional Economics: Market Segmentation

3.1 Introduction

In this chapter, I study the economic efficiency of input factors mobility across both symmetric and asymmetric markets. Thus, the primary aim is to contribute to shed light on whether a full integration of countries, regions or industrial sectors is always Pareto-efficient or not. In case it is not, I seek to find out in which cases and to which extent such mobility should be restricted in order to obtain Pareto-improvements at the global level. Finally, I turn to individual markets' side to establish, eventually, which one gains and which one loses after integration with the other markets.

More specifically, I analytically compare two different frameworks. The first one is a fully integrated economy, where both the production factors, i.e. capital and labour, are assumed to be free mobile across markets. The second one, instead, is a partially integrated economy, where only one factor is assumed to be free mobile, while the other one is constrained by each individual market' borders. So, capital is assumed to be the free mobile input factor, that freely flows across countries and regions; in addition, labour is segmented so as to model difficulties of labour migrating across international barriers (in a trade context) or from a poor region to a richer one (in a regional context). Thus, from a more empirical point of view, the model I set aims at analyzing the impact of competition regulations on wages and financial flows both in the regional and international context, and the potential output, welfare and financial implications of relaxing immigration laws. Furthermore, these issues will be addressed both at the aggregate level and at the individual market level.

In more practical terms, by this framework, I wish to contribute to a better understanding of how effective current agreements on production factors mobility are, especially within the European Union. Moreover, I would also argue about the economic opportunity to further extend such agreements to other countries.[3]In fact, most of the concerns about the latter point are not so different from those that came up before the enlargement to the Central and Eastern countries in 2004. More specifically, as argued in Boeri and Brücker (2001), large income and wage asymmetries between member states and candidates had raised many issues about labour markets and income distribution. In particular, those issues regarded living standards of low-skilled workers, that were threatened by an expected increase of both the inflow of low-cost workers and the out-flow of plants from the West to the East. Indeed, it is not difficult to find out a large literature somehow supporting those fears that, actually, might also sound as fairly intuitive. Samuelson (1964) already pointed

[3]Currently, candidate countries to access the EU are: Croatia, Iceland, Macedonia, Montenegro and Turkey.

out that after World War I constraints to immigration were trying to keep native workers' wages high. Card (2001), in an empirical work on US data, found that migration inflows were related to larger unemployment rates among natives and earlier immigrants (even though the effects on the wage structure was marginal). Particularly, they estimated that the arrival of immigrants between 1985 and 1990 reduced the employment rate of low-skilled natives in the most important US cities by 1-2 percents on average. Borjas (2003), instead, discovered some significant effects of immigration in terms of wages. He focused on the migration flow that between 1980 and 2000 had increased the labour supply of male workers in the US by 11 percent. Despite of positive effects of the arrival of low-skilled workers on the wages of the high-skilled ones, he estimated that the inflow of foreign workers had reduced the wages of native workers by 3.2 percent. Of course, the effect was larger for low-educated workers, that loss 8.9 percent of their wage on average.

Turning back to my model, it particularly aims at studying the implications of heterogeneity in market competition degrees within the context of integration of regional/national markets. In fact, one of the crucial targets at the origin of the European Union is to generate and promote a Single Market and, of course, full mobility of input factors, namely both capital and labour, turns out to be really important for that purpose.[4] My ambition is to assess the optimal degree of input market integration both in case of symmetry and in case of asymmetry. Is full integration of input factors always Pareto-efficient ? In the cases in which it is not, which is the optimal extent of integration or, from another point of view, which is the optimal extent of inputs restriction? Thus, what I argue is that, once markets get integrated, free trade of input factors across borders might raise problems as consequences of such heterogeneity in market competitiveness. One of the possible problems I consider is that if migration barriers are lowered, then an excess of migratory flows to more competitive national markets could be expected and lead to welfare losses. Intuitively, this would happen because, in relative terms, markets with larger demand elasticities, *ceteris paribus*, will result to have lower prices of the goods and, consequently, larger real wages. Then, the latter might push (too) many workers to leave markets where firms' monopoly power is relatively higher. Moreover, too many workers moving to one side of this single market might are also associated to an excess of capital investments into the same direction: this is because capital and labour are normally thought of as having some degree of complementarity with each other. Therefore, the final outcome is that there are some parts of the single market producing "too much" and other parts producing "too little", so leading to welfare losses.

So far, problems related to factors mobility within the European Union have been mostly studied from the economic geography perspective. More specifically, it has been

[4]See Mario Monti's report to the President of the European Commission, Josè Manuel Barroso, " A new strategy fo the single market" (2010) as an important document that reveals the policy targets that are pursued by the European Union.

showed that the common European market has enhanced processes of concentration of economic activities and specialization of economic areas and, so doing, has increased the risk of asymmetric shocks. Making some examples, Amiti (1998) found an increase in the geographical concentration of production within EU countries. Furthermore, she also showed that the majority of industrial sectors tend to be more agglomerated within the European Union as a whole. She explained that result by Krugman's argument: increasing return-to-scale sectors are more likely to be geographically concentrated within large demand areas and to employ a large proportion of intermediate inputs. Thus, she expected the monetary union to enhance such a geographical concentration and, consequently, to increase the likelihood of asymmetric shocks. Ottaviano and Puga (1998) stated that integration of national markets within the European Union was making "central" regions stronger and stronger because they were able to attract the most modern production sectors; on the other side, this was weakening the "peripheral" areas as they could only keep traditional and less productive industries. Kalemli-Ozcan, Sorensen and Yosha (2001) showed that OECD countries and US states that are more industrially specialized have output shocks that are relatively less correlated to aggregate output in respectively, OECD and the US. They found that higher specialization is due to the removal of trade barriers, that allows to spread the risk of specialization in international capital market. Midelfart, Overman and Venables (2003) provided some empirical evidence about clustering and specialization within the EU area: labour intensive industries seem to be more concentrated in the South of the EU, while service sector is more concentrated in the central regions. More particularly, some countries, such as Greece, Portugal and Finland, have manufacturing production structures that are very different from the other countries. They pointed out that trade integration is an incentive to cluster in order to exploit comparative advantages. This is because it lowers the producers' need of producing next to consumers. The expected consequence of production specialization is to make EU members more vulnerable to asymmetric shocks. Furthermore, market forces seem to move economic activity from the "periphery" to the central regions and this cannot be offset by factor price differences anymore. Thus, with respect to the New Economic Geography literature, I do not focus problems deriving from heterogeneity in demand size across integrated areas but on problems deriving on heterogeneity in market structure. More specifically, the reference literature highlights that trade integration can be an incentive for producers to cluster over large-demand areas in order to exploit increasing returns to scale: in turn, this increases the risk for asymmetric shocks. Instead, as it will be shown next, my work points out that input factors integration can yield overproduction within relatively larger demand elasticity markets and underproduction within relatively lower demand elasticity areas, so as to lead to an inefficient amount of production at the aggregate level.

3.2 The model

3.2.1 Outline

I present a static general equilibrium economy, such that all the production is consumed. There is one final good produced according to a nested standard CES production function *a là* Bhaskar. There are three distinct levels of production: individual producers, industrial sectors [5] and aggregate economy. Thus, on the one hand, the aggregate economy produces one final good according to a standard CES function that aggregates products coming from industries. On the other hand, industrial sectors produce according to a CES function that aggregates intermediate inputs. Finally, the latter are produced by heterogeneous monopolistically competitive firms that have to hire both the input factors, which are labour and capital. Notice that I assume there is a large number, that is S, of industrial sectors; in addition, within each industry, a large number of monopolistically competitive firms, that is N_s, operates. In terms of notation, industries are indicated by the index $s \in [1, S]$, whilst firms within sector s are indicated by the index $n \in [1, N_s]$.[6]

I set two different economic frameworks[7]: in the first one, labour is allowed to be free mobile across sectors; in the second one, labour is restricted at the industry level such as capital in both the settings. The two models' equilibria turn out to be crucially different in terms of aggregate production, intermediate inputs costs and factors allocation. In particular, in the fully integrated economy equilibrium wage is unique such as the rental in both the settings, whilst in the second setting, where labour mobility is restricted, wages differ across industries.

Furthermore, there is one representative agent, which inelastically supplies an exogenously fixed amount of capital $\overline{K}$ through all the economy and a fixed amount of labour, that is $\overline{L}_s$ to the individual industries in the first setting, and the aggregate $\overline{L}$ through all the economy in the second one. I add one more production factor, namely capital, in order to also exploit my model to investigate the effects of market integration not only on wages but also on financial flows. Furthermore, this gives me the opportunity to compare the full integration case, in which all the input factors are mobile, with the partial integration case, in which one factor in segmented and the other is free to move across borders (see Ottaviano and Thisse, 2002 and Kessler, Lulfesmann and Myers, 2002).

Figure 3.1 below graphically shows the two settings.

[5] In a first stage, I mainly define sectors as industries. However, in a second stage, I am going to exploit them according to a broader meaning, such that I can also use them to study some issues concerning international economics.

[6] Notice that the number of monopolistic firms, N_s, is allowed to differ across industries.

[7] In the appendix, I also provide one more setting in which both capital and labour are segmented at the sector level.

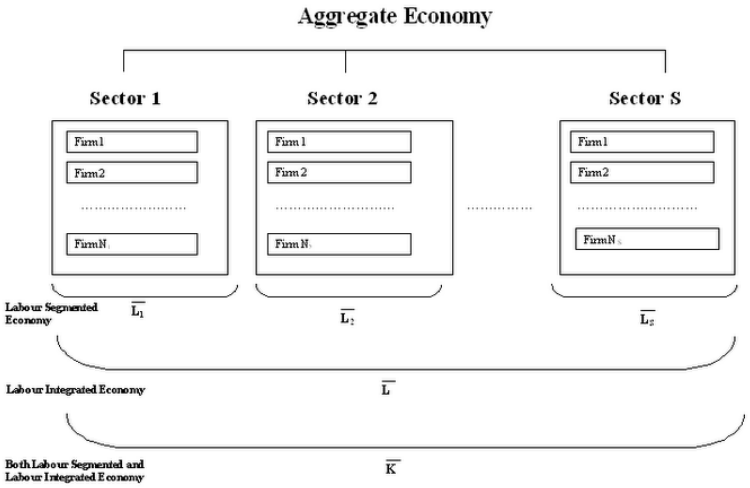


Figure 3.1. Description of the model

3.2.2 Preferences and technology

Final good sector and industrial sectors

On the one hand, the final good sector, operating under perfect competition, uses the very large number of goods produced at the industry level to produce the final good according to the standard CES aggregation function[8]

$$Y = \left[\frac{1}{S^{1-\delta}} \sum_{s=1}^{S} Y_s^{\delta} \right]^{\frac{1}{\delta}}, \qquad \delta \in (0,1), \tag{1}$$

where Y is the aggregate output of the final good sector. The latter will make zero profits, as well as the industrial sectors, since the production function shows constant returns to scale in the inputs, that are the industry level products, Y_s , and since this sector is perfectly competitive. Moreover, given the production technology, one unit of the output produced by sector s, is used as a composite input for producing one unit of the aggregate final output. The elasticity of substitution between any two products is $1/(\delta - 1)$. Furthermore, the global sector generates a derived demand for the differentiated products produced by industries, that will be shown next.

On the other hand, each industrial sector also produces according a standard CES aggregation function using the very large number of specialized inputs $q_{n,s}$,

[8] See, for instance, Bénassy (1996 a,b).

$$Y_s = \left[\frac{1}{N_s^{1-\rho_s}} \sum_{n=1}^{N_s} q_{n,s}^{\rho_s} \right]^{\frac{1}{\rho_s}}, \qquad \rho_s \in (0,1), \tag{2}$$

where Y_s is the aggregate output of the industry s, and $q_{n,s}$ is output of monopolistic firm n within sector s. Even in this case, since the production function shows constant returns and this sector is perfectly competitive, the profits made will be zero. As for the final good sector, one unit of the output produced by firm n in sector s is used as a composite input for producing one unit of the aggregate output of sector s. The elasticity of substitution between any two products within sector s is $1/(\rho_s - 1)$ and, crucially, it is allowed to vary across the industries. This is to capture the heterogeneity in the *toughness of price competition* across markets. Indeed, many factors, some potentially related to each other, can determine such an asymmetry: horizontal product differentiation across firms (Dixit, Stiglitz, 1977), the number of competitors (Dunne, Klimek, Roberts, Xu, 2009), preference for variety (Bilbiie, Ghironi, Melitz, 2007; Epifani and Gancia, 2011), producers' clusters, geographic segmentation and transport costs (Syverson, 2004), institutional factors, such as barriers to entry, price controls (upper), operational restrictions, public sector size (see Hopenhayn, 1992; Aghion, Harris, Howitt, and Vickers, 2001; Ryan, 2006) [9] . Of course, the latter is just a short list, but the point I am trying to make here is that demand elasticity can well summarize several economic structure features, at least from a static point of view. Then, the industrial sector creates a derived demand for the differentiated products, that will be shown next.

Derived demand

Cost minimization of (1) generates the derived demand for the industry level good Y_s as a function of its own price $\widetilde{p}_s$, the price of the final good p, that is taken as the numeraire, and the total output of the final good Y,

$$Y_s \equiv \left[\frac{p}{\widetilde{p}_s} \right]^{\frac{1}{1-\delta}} \frac{Y}{S}, \qquad \text{with} \quad \frac{1}{p^\nu} \equiv \frac{1}{S} \sum_{s=1}^{S} \frac{1}{\widetilde{p}_s^\nu}, \tag{3}$$

with $\nu \equiv \delta/(1-\delta) \in \mathbf{R}_+$.

Cost minimization of (2) generates the derived demand for the specialized input $q_{n,s}$ as a function of its own price $\widetilde{p}_{n,s}$, of the price of the region level good $\widetilde{p}_s$ and of the total output of the regional good Y_s,

$$q_{n,s} \equiv \left[\frac{\widetilde{p}_s}{\widetilde{p}_{n,s}} \right]^{\frac{1}{1-\rho_s}} \frac{Y_s}{N_s}, \qquad \text{with} \quad \frac{1}{\widetilde{p}_s^{\mu_s}} \equiv \frac{1}{N_s} \sum_{n=1}^{N_s} \frac{1}{\widetilde{p}_{n,s}^{\mu_s}}, \tag{4}$$

with $\mu_s \equiv \rho_s/(1-\rho_s) \in \mathbf{R}_+$.

Putting the derived demand for the industry good (3) into the latter yields

[9] See also Berry and Reiss, 2007 for a review.

$$q_{n,s} \equiv \left[\frac{\widetilde{p}_s}{\widetilde{p}_{n,s}}\right]^{\frac{1}{1-\rho_s}} \left[\frac{p}{\widetilde{p}_s}\right]^{\frac{1}{1-\delta}} \frac{Y}{SN_s}.$$

Specialized firms

In an industry s, there is a fixed large number N_s of monopolistically competitive firms, each one producing a differentiated product. Firm $n\,,s$ produces according to a standard Cobb-Douglas production function, which takes capital and labour as inputs

$$q_{n,s} = \theta_{n,s} k_{n,s}^{\gamma} l_{n,s}^{1-\gamma}, \qquad \gamma \in (0,1)\,, \tag{5}$$

where $q_{n,s}$ is its output, $\theta_{n,s}$ is its technical efficiency, whilst $k_{n,s}$ and $l_{n,s}$ are the inputs of, respectively, capital and labour used up by the firm.

3.2.3 Labour integrated economy

Welfare

Within an industrial sector s, the welfare function, I_s, is given by summing up all N_s firms' profits, $\widetilde{\pi}_{n,s}$,with $n \in [1, N_s]$, labour and capital income

$$I_s = \sum_{n=1}^{N_s} \widetilde{\pi}_{n,s} + \widetilde{i}\widehat{K}_s + \widetilde{w}\overline{L}_s, \tag{6}$$

where $\widehat{K}_s$ is the capital owned by sector s, $\widetilde{i}$ is the nominal rental rate,$\overline{L}_s$ is the exogenous labour supply in industry s and, finally, $\widetilde{w}$ is the nominal wage rate. At the aggregate level, the welfare is given by adding up all the industry level welfare.

Producer optimization

The monopolistic firms have to hire physical capital and labour on competitive, respectively, capital and labour markets, because they do not own any input factor. The nominal profit of firm n, s is

$$\widetilde{\pi}_{n,s} \equiv \widetilde{p}_{n,s} q_{n,s} - \left(\widetilde{i} k_{n,s} + \widetilde{w} l_{n,s}\right),$$

where $\widetilde{p}_{n,s}$ is the nominal price of the product,whilst $k_{n,s}$ and $l_{n,s}$ are, respectively, the capital and labour demand from the producer n, s. As both the labour and the capital market are fully integrated, the wage rate and the rental rate are unique over the whole economy. Each firm n, s faces a demand curve, $q_{n,s}$, that I will derive next and seek to maximize its profit

$$\max_{k_{n,s}, l_{n,s}} \widetilde{p}_{n,s} q_{n,s} - \left(\widetilde{i} k_{n,s} + \widetilde{w} l_{n,s}\right), \quad \text{subject to } \theta_{n,s} k_{n,s}^{\gamma} l_{n,s}^{1-\gamma} = q_{n,s}. \tag{7}$$

Thus, each monopolistically competitive firm n, s faces the minimization problem in (7),

in order to derive the minimal unit cost. The result is that each agent over all the economy will choose to operate with the same capital/labour ratio κ:

$$\frac{k_{n,s}}{l_{n,s}} = \frac{\gamma}{1-\gamma}\frac{w}{i} = \kappa. \tag{8}$$

Finally, the derived demand for labour and capital by firm n, s producing $q_{n,s}$ is

$$k_{n,s} = \frac{\kappa^{1-\gamma} q_{n,s}}{\theta_{n,s}} \quad , \quad l_{n,s} = \frac{q_{n,s}}{\theta_{n,s}\kappa^{\gamma}}. \tag{9}$$

In order to make both the capital and the labour market clear, it must be that the sum of all firms' demand for capital and labour is equal to the stocks of, respectively, capital ($\overline{K}$) and labour ($\overline{L}$), that are inelastically supplied at the aggregate level. Thus, since all the firms in this economy will use the same capital/labour ratio (8), the two input markets will clear if the following condition holds:

$$\overline{K} = \sum_{s=1}^{S}\sum_{n=1}^{N_s} k_{n,s} = \sum_{s=1}^{S}\sum_{n=1}^{N_s} \frac{k_{n,s}}{l_{n,s}} l_{n,s} = k \sum_{s=1}^{S}\sum_{n=1}^{N_s} l_{n,s} = \kappa \overline{L}.$$

Optimal prices

As a monopolist, the intermediate input firm seeks to maximize its profit by charging price $\widetilde{p}_{n,s}$ that is equal to a fixed mark-up $(1/\rho_s)$ over marginal cost. Using the optimal capital/labour ratio (8) and the derived demand for capital and labour (9) yields the price charged by firm n, s

$$\widetilde{p}_{n\,,s} = \frac{w}{(1-\gamma)\,\rho_s \kappa^{\gamma} \theta_{n,s}} p. \tag{10}$$

Notice that the industry level average productivity is given by

$$\theta_s^{\mu_s} = \frac{1}{N_s}\sum_{n=1}^{N_s} \theta_{n,s}^{\mu_s}. \tag{11}$$

Using sector level price aggregation (4) and sector level productivity aggregation (11) yields that, within each sector s, the relative price is inversely proportional to the relative productivity:

$$\frac{\widetilde{p}_{n\,,s}}{\widetilde{p}_s} = \frac{\theta_s}{\theta_{n,s}}. \tag{12}$$

Moreover, aggregating (10) at the sector level and using (11) yields:

$$\widetilde{p}_s = \frac{w}{(1-\gamma)\,\rho_s \kappa^{\gamma} \theta_s} p.$$

Then, dividing the latter by the result of price aggregation at the aggregate level (using

3) gives:

$$\frac{\widetilde{p}_s}{p} = \frac{\left[\frac{1}{S}\sum_{s=1}^{S}(\theta_s\rho_s)^{\nu}\right]^{\frac{1}{\nu}}}{\theta_s\rho_s}. \tag{13}$$

Therefore, the sector relative price turns out to be a decreasing function of both industry level aggregate productivity, θ_s, and industry level demand elasticity, ρ_s: the more competitive and/or the more productive markets will turn out to have relatively lower aggregate prices. In addition, notice that, according to this setting, sector relative price is scaled up by an aggregation of all industry level aggregate productivities and all intra-industry demand elasticities. Using the labour and capital demand (9), the derived demand for specialized good (4), the sector level productivity aggregation (11) and the assumption that both capital and labour are inelastically supplied at the global level, I derive that the optimal capital/labour ratio is simply equal to the ratio between the exogenous global capital stock ($\overline{K}$) and the exogenous global labour stock ($\overline{L}$). From the latter and the equation of the sector level price (13), it turns out that the real rental rate and the real wage rate are, respectively,

$$i = \gamma\left(\frac{\overline{L}}{\overline{K}}\right)^{1-\gamma}\left[\frac{1}{S}\sum_{s=1}^{S}(\theta_s\rho_s)^{\nu}\right]^{\frac{1}{\nu}}, \tag{14}$$

$$w = (1-\gamma)\left(\frac{\overline{K}}{\overline{L}}\right)^{\gamma}\left[\frac{1}{S}\sum_{s=1}^{S}(\theta_s\rho_s)^{\nu}\right]^{\frac{1}{\nu}}. \tag{15}$$

Both the real wage, w, and the real interest rate, i, are functions of the aggregate capital stock and the aggregate labour stock: particularly, the larger the capital stock with respect to the labour stock, the larger the wage rate, the lower the rental rate. Moreover, they both result to be increasing functions of an aggregation of industry level aggregate productivities and demand elasticities: the larger the productivity and the larger the demand elasticity in each sector, the larger the remuneration of both the two input factors.

Factor allocation and final output

Substituting the price ratios (12 and 13) into the derived demand for specialized input (4), and then putting the result into the aggregate output function yields (1):

$$Y = \frac{\overline{K}^{\gamma}\overline{L}^{1-\gamma}\left[\sum_{s=1}^{S}(\theta_s\rho_s)^{\nu}\right]^{\frac{1}{\delta}}}{S^{\frac{1}{\nu}}\sum_{s=1}^{S}\theta_s^{\nu}\rho_s^{\frac{1}{1-\delta}}}. \tag{16}$$

So, the aggregate output turns out to be an increasing function of both aggregate capital and aggregate labour stocks. Furthermore, all the industry level aggregate productivities and all the intra-industry demand elasticities are arguments of this function. Using the

latter and the relative prices (12 and 13), I can also derive firm n, s' production

$$q_{n,s} = \frac{\theta_s^{\frac{\delta-\rho_s}{(1-\delta)(1-\rho_s)}} \rho_s^{\frac{1}{1-\delta}} \theta_{n,s}^{\frac{1}{1-\rho_s}} \overline{K}^{\gamma} \overline{L}^{1-\gamma}}{N_s \left[\sum_{s=1}^{S} \theta_s^{\nu} \rho_s^{\frac{1}{1-\delta}}\right]}. \tag{17}$$

Thus, it results that the distribution of the aggregate production across firms within each sector is a function of the aggregate stocks of both capital and labour, $\overline{K}$ and $\overline{L}$, the industry level demand elasticity, ρ_s, the industry level aggregate productivity, θ_s and firm level productivity, $\theta_{n,s}$. Indeed, the value of the firm level production is scaled down by an aggregation of the aggregate productivities and the demand elasticities of all the industries other than by the number of producers within the respective sector, N_s. Finally, substituting the firm level production and the optimal capital/ labour ratio into the derived demand for labour and capital (9) yields the factor allocation:

$$k_{n,s} = \frac{\rho_s^{\frac{1}{1-\delta}} \theta_{n,s}^{\mu_s} \theta_s^{\frac{\delta-\rho_s}{(1-\delta)(1-\rho_s)}} \overline{K}}{N_s \sum_{s=1}^{S} \theta_s^{\nu} \rho_s^{\frac{1}{1-\delta}}}, \tag{18}$$

$$l_{n,s} = \frac{\rho_s^{\frac{1}{1-\delta}} \theta_{n,s}^{\mu_s} \theta_s^{\frac{\delta-\rho_s}{(1-\delta)(1-\rho_s)}} \overline{L}}{N_s \sum_{s=1}^{S} \theta_s^{\nu} \rho_s^{\frac{1}{1-\delta}}}. \tag{19}$$

Therefore, at the firm level, both capital and labour allocations turn out to be increasing functions of the firm level productivity, $\theta_{n,s}$, the relative industry aggregate productivity, θ_s, the relative industry demand elasticity, ρ_s, and the aggregate stocks of, respectively, capital and labour. In addition, allocations are scaled down by the number of competitors within the relative sector, N_s, and an aggregation of all the industry level productivities and demand elasticities.

3.2.4 Labour restricted economy

In this second framework, I assume labour mobility to be restricted at the sector level, while capital is free mobile such as in the first setting.

Welfare

In an industry s, the welfare function, I_s^* is given by summing up all firms' profits, $\widetilde{\pi}_{n,s}^*$, with $n \in [1, N_s]$, labour and capital incomes:

$$I_s^* = \sum_{n=1}^{N_s} \widetilde{\pi}_{n,s}^* + \widetilde{i}^* \widehat{K}_s + \widetilde{w}_s^* \overline{L}_s,^{10} \tag{20}$$

[10] Within an international framework, (20) represents the aggregate income of country s, given the stock of population, $\overline{L}_s$, and the stock of capital owned by country s' population, $\widehat{K}_s$. I will exploit this function, along with (6), for comparative statics exercises in section 3.4, where I compare the integrated

where $\widehat{K}_s$ is the amount of capital assumed to be owned by sector s, $\widetilde{i}^*$ is the nominal value of the interest rate, $\widetilde{w}_s^*$ is the nominal wage rate in industry s and $\overline{L}_s$ is the exogenous labour supply in sector s. At the aggregate level, the total welfare is given by adding up all the industry level welfares. Notice that I use asterisk as a superscript to indicate the variables from the labour restricted model, and differentiate them from the ones coming from the first setting, where labour markets are perfectly integrated.

Producer optimization

Even in this setting, the monopolistic firms have to hire both physical capital and labour on competitive input factor markets, because they do not own any input factor. The nominal profit of firm n, s is

$$\widetilde{\pi}_{n,s}^* \equiv \widetilde{p}_{n,s}^* q_{n,s}^* - \left(\widetilde{i}^* k_{n,s}^* + \widetilde{w}_s^* l_{n,s}^*\right),$$

where $\widetilde{p}_{n,s}^*$ is the nominal price charged by firm n, s, $k_{n,s}^*$ and $l_{n,s}^*$ are, respectively, the demand of capital and labour from the same firm. Notice that, as the labour market is segmented, nominal wages result to be different across industries. The interest rate, instead, is the same over all sectors, as capital is assumed to be free mobile.

Thus, firm n, s faces the demand curve such as the one shown before (4) and seeks to maximize its profit:

$$\max_{k_{n,s}^*, l_{n,s}^*} \widetilde{p}_{n,s}^* q_{n,s}^* - \left(\widetilde{i}^* k_{n,s}^* + \widetilde{w}_s^* l_{n,s}^*\right), \quad \text{subject to} \quad \theta_{n,s} k_{n,s}^{*\gamma} l_{n,s}^{*(1-\gamma)} = q_{n,s}^*. \tag{21}$$

Each monopolistically competitive firm faces the minimization problem in (21), in order to derive the minimal unit cost. The result is that each agent within the same industry will choose to operate with the same capital/labour ratio κ_s

$$\frac{k_{n,s}^*}{l_{n,s}^*} = \frac{\gamma}{1-\gamma}\frac{w_s^*}{i^*} = \kappa_s^*, \tag{22}$$

The derived demand for labour and capital by firm n, s producing $q_{n,s}^*$ is

$$k_{n,s}^* = \frac{\kappa_s^{*(1-\gamma)} q_{n,s}^*}{\theta_{n,s}} \quad \text{and} \quad l_{n,s}^* = \frac{q_{n,s}^*}{\theta_{n,s} \kappa_s^{*\gamma}}. \tag{23}$$

In order to make both the capital and the labour market clear, it must be that the sum of all firms' derived demand for capital and labour is equal to the stocks of inputs that are inelastically supplied at the aggregate level in case of the capital market, $\overline{K}$, and at the sectoral level in case of the labour market, $\overline{L}_s$. Thus, since all the firms within each sector share the same capital/labour ratio (22), the two input markets will clear if the following condition holds:

economy and the labour restricted economy both at the global and at the individual country level.

$$\overline{K} = \sum_{s=1}^{S} \kappa_s^* \overline{L}_s. \tag{24}$$

Optimal prices

As a monopolist, the intermediate input firm n, s seeks to maximize its profit by charging a price $\widetilde{p}_{n,s}^*$ that is equal to a fixed mark-up $(1/\rho_s)$ over marginal cost. Using the optimal capital/labour ratio (22) and the derived demand for capital and labour (23) yields the price charged by firm n, s

$$\widetilde{p}_{n,s}^* = \frac{w_s^*}{(1-\gamma)\,\rho_s \kappa_s^{*\gamma} \theta_{n,s}} p^*. \tag{25}$$

Using the latter and the sector level price aggregation (4) yields that, within sector s, firm n, s relative price is inversely proportional to firm n, s relative productivity, i.e.

$$\frac{\widetilde{p}_{n,s}^*}{\widetilde{p}_s^*} = \frac{\theta_s}{\theta_{n,s}}. \tag{26}$$

Using the latter, the aggregate production function (1), the derived demand for specialized inputs (4), the optimal capital-labour ratio (22), the input market clearing condition (24), the optimal price charged by firm n, s (25), and the assumption that labour is inelastically supplied at the sector level, I find that

$$\frac{\widetilde{p}_s^*}{p^*} = \frac{\left[\frac{1}{S}\sum_{s=1}^{S}\left(\theta_s \rho_s^{\gamma} \bar{L}_s^{1-\gamma}\right)^{\frac{\delta}{1-\gamma\delta}}\right]^{\frac{1}{\nu}}}{\left[\theta_s \rho_s^{\gamma} \bar{L}_s^{1-\gamma}\right]^{\frac{1-\delta}{1-\gamma\delta}}}. \tag{27}$$

Thus, industry level relative price turns out to be a decreasing function of the labour inelastically supplied in that sector, $\bar{L}_s$, the industry level aggregate productivity, θ_s, and the within industry demand elasticity, ρ_s; indeed, it also results to be scaled up by a function of all the industry level aggregate productivities, demand elasticities and exogenous labour supplies. Particularly, with respect to the industry level relative price in the integrated market, in this case industry relative labour supply is one of the arguments of the function: the larger the exogenous allocation of labour in sector s, the lower the unit cost (through lower wage rate), the lower the relative price. Furthermore, differently from the previous case, the elasticity of firms' output elasticity of capital, i.e. γ, also results to affect the industry level relative price.

Rearranging the optimal price at the firm level (25) for the real wage and substituting the result into the optimal capital-labour ratio (22), and then what I find into the input market clearing equation (24), and recalling the industry relative price (27), I can derive the real rental rate, that, as expected, turns out to be a decreasing function of the capital stock, $\bar{K}$:

$$i^* = \frac{\gamma \left[\frac{1}{S}\sum_{s=1}^{S}\left(\theta_s \rho_s^{\gamma} \bar{L}_s^{1-\gamma}\right)^{\frac{\delta}{1-\gamma\delta}}\right]^{\frac{1}{\nu}} \left[\sum_{s=1}^{S}\left(\theta_s^{\delta}\rho_s \bar{L}_s^{\delta(1-\gamma)}\right)^{\frac{1}{1-\gamma\delta}}\right]^{1-\gamma}}{\bar{K}^{1-\gamma}}. \tag{28}$$

Using the latter, the optimal capital/labour ratio (22) and the sector relative price (27) yields the real wage rate

$$w_s^* = \frac{(1-\gamma)\,\bar{K}^{\gamma}\rho_s^{\frac{1}{1-\delta\gamma}}\theta_s^{\frac{\delta}{1-\delta\gamma}}\left[\frac{1}{S}\sum_{s=1}^{S}\left(\theta_s\rho_s^{\gamma}\bar{L}_s^{1-\gamma}\right)^{\frac{\delta}{1-\gamma\delta}}\right]^{\frac{1}{\nu}}}{\bar{L}_s^{\frac{1-\delta}{1-\gamma\delta}}\left[\sum_{s=1}^{S}\left(\theta_s^{\delta}\rho_s\bar{L}_s^{\delta(1-\gamma)}\right)^{\frac{1}{1-\delta\gamma}}\right]^{\gamma}}. \tag{29}$$

Even for input factors prices, in the labour segmented economy, industry level labour supplies are arguments of the respective functions. Namely, in terms of sector relative wage rate, the larger the aggregate capital stock, $\bar{K}$, the larger the demand elasticity, ρ_s, the larger the industry relative aggregate productivity, θ_s, the larger the labour price in industry s. Thus, the relatively more competitive, more productive and less labour intensive industries will have higher real wages. On the other side, the real interest rate is decreasing with respect to the aggregate capital stock, $\bar{K}$.

Factor allocation and final output

Substituting price ratios (26) and (27) into the derived demand for specialized input (4), and using the latter to replace $q_{n,s}$ into the firms' demand for labour (23), and aggregating labour demand over all monopoly firm by recalling that labour is inelastically supplied at the sector level, $\overline{L}_s$, I can derive the global production

$$\overline{L}_s = \sum_{n=1}^{N_s} l_{n,s}^* \Longleftrightarrow Y = S\overline{L}_s \kappa_s^{*\gamma}\theta_s \left[\frac{\widetilde{p}_s^*}{p^*}\right]^{\frac{1}{1-\delta}}. \tag{30}$$

Thus, considering the optimal capital/labour ratio (22),the equations for real rental rate and the real wage rate (28 and 29), and the price equation in (27), the final good production is

$$Y^* = \frac{\bar{K}^{\gamma}\left[\sum_{s=1}^{S}\left(\theta_s\rho_s^{\gamma}\bar{L}_s^{1-\gamma}\right)^{\frac{\delta}{1-\gamma\delta}}\right]^{\frac{1}{\delta}}}{S^{\frac{1}{\nu}\left[\sum_{s=1}^{S}\left(\theta_s^{\delta}\rho_s\bar{L}_s^{1-\gamma}\right)^{\frac{1}{1-\gamma\delta}}\right]^{\gamma}}}. \tag{31}$$

Even in this case, the aggregate economy output is a function of all the intra-industry demand elasticities of the economy, along with all the exogeneous labour supplies at the industry level and industry level aggregate productivities. Of course, the larger the aggregate capital stock, the larger the aggregate economy output. From the latter and the relative prices (26 and 27), I can derive the production at the firm level

$$q^*_{n,s} = \frac{\theta_{n,s}^{\frac{1}{1-\rho_s}} \bar{L}_s^{\frac{1-\gamma}{1-\gamma\delta}} \theta_s^{\frac{\gamma\delta-\rho_s}{(1-\gamma\delta)(1-\rho_s)}} \bar{K}^{\gamma} \rho_s^{\frac{\gamma}{1-\gamma\delta}}}{\left[\sum_{s=1}^{S} \left(\theta_s^{\delta} \rho_s \bar{L}_s^{\delta(1-\gamma)}\right)^{\frac{1}{1-\gamma\delta}}\right]^{\gamma} N_s}. \tag{32}$$

Thus, in the framework with restrictions to labour mobility, production distribution across firms within each sector s depends on both the firm level and the industry level productivities, along with capital and labour stocks and sector relative demand elasticity.

Finally, substituting the firm level production (32) ,the optimal capital-labour ratio (22), along with the real rental rate and the real wage rate (28 and 29), into the derived demand for labour and capital (23), I find the optimal factor allocation

$$k^*_{n,s} = \frac{\theta_{n,s}^{\frac{\rho_s}{1-\rho_s}} \bar{L}_s^{\frac{(1-\gamma)\delta}{1-\gamma\delta}} \theta_s^{\frac{\rho_s\delta(\gamma-1)+\delta-\rho_s}{(1-\gamma\delta)(1-\rho_s)}} \bar{K} \rho_s^{\frac{1}{1-\gamma\delta}}}{N_s \sum_{s=1}^{S} \left(\theta_s^{\delta} \rho_s \bar{L}_s^{\delta(1-\gamma)}\right)^{\frac{1}{1-\gamma\delta}}}, \tag{33}$$

$$l^*_{n,s} = \frac{\bar{L}_s \theta_{n,s}^{\frac{\rho_s}{1-\rho_s}}}{N_s \theta_s^{\frac{\rho_s}{1-\rho_s}}}. \tag{34}$$

Therefore, at the firm level, capital allocation turns out to be a function of all the parameters ruling this economy. Instead, labour is allocated according the average size and relative productivity of the firm within its own sector[7]. Particularly, labour distribution is affected only by the parameters at the sector level: this result exactly matches what I would find in a one sector economy[8].

3.3 Social planner solution and efficiency analysis

3.3.1 *The social planner solution*

In order to evaluate and compare the efficiency of the two types of market illustrated before (i.e. fully integrated and labour restricted), I solve the social planner problem and use the solution as a benchmark. More specifically, I imagine a benevolent planner that maximizes the utility of a representative household by allocating input factors across all the firms in the economy directly, subject only to the aggregate resources constraints, i.e.$\overline{K}$ and $\overline{L}$ (see Bilbiie, Ghironi and Melitz, 2008; Epifani and Gancia, 2011.) Thus, the social planner optimizes the distribution of input factors over the whole economy. Assuming both capital and labour to be inelastically supplied at the global level, she faces the following optimization problem :

[7] In the appendix, I will show that in a framework in which both capital and labour are segmented at the sector level, the two input factors are distributed as labour in (34), that means they both turn out to be functions of the firm's relative productivity and its average size.

[8] See, for example, Abadir and Talmain (*Review of Economic Studies*, 2002).

$$\max_{\left\{\{k_{n,s},l_{n,s}\}_{n=1}^{N_s}\right\}_{s=1}^{S}} Y = \left[\frac{1}{S^{1-\delta}}\sum_{s=1}^{S}\left(\frac{1}{N_s^{1-\rho_s}}\sum_{n}^{N_s}\left(\theta_{n,s}k_{n,s}^{\gamma}l_{n,s}^{1-\gamma}\right)^{\rho_s}\right)^{\frac{\delta}{\rho_s}}\right]^{\frac{1}{\delta}}.$$

Thus, capital and labour turn out to be distributed at the firm level as follows:

$$\begin{aligned} k_{n,s} &= \frac{\overline{K}\theta_s^{\frac{\delta-\rho_s}{(1-\rho_s)(1-\delta)}}\theta_{n,s}^{\mu_s}}{SN_s\theta^{\nu}}, \\ l_{n,s} &= \frac{\overline{L}\theta_s^{\frac{\delta-\rho_s}{(1-\rho_s)(1-\delta)}}\theta_{n,s}^{\mu_s}}{SN_s\theta^{\nu}}, \end{aligned} \tag{35}$$

where the global economy average productivity is given by the following function:

$$\theta^{\nu} = \frac{1}{S}\sum_{s=1}^{S}\theta_s^{\nu}.$$

The model with full integration of input factors matches what found by the social planner only if within sector demand elasticities are equal. Furthermore, the distribution of production factors according to the model in which labour is assumed to be restricted at the sector level also matches (35), if within sector demand elasticities are the same and, moreover, labour supplied at the sector level is equal to

$$\overline{L}_s = \frac{\overline{L}}{S}\left(\frac{\theta_s}{\theta}\right)^{\frac{\delta}{1-\delta}}{}^{11}.$$

Finally, the aggregate economy output produced by the Social Planner is a simple CD function, as follows:

$$Y = \theta\overline{K}^{\gamma}\overline{L}^{1-\gamma}.$$

3.3.2 *Efficiency analysis*

As it can be easily observed, neither the integrated setting nor the labour segmented one are able to provide a fully efficient allocation of input factors, namely capital and labour, across industries and monopolistic firms, as long as industry level demand elasticities are heterogeneous. This means that, in both the cases, market solution does not actually match the Social Planner allocation of input factors and, in turn, does not produce as much as the Social Planner does. Here, the aggregate output can be thought of as a measure of welfare for the entire economy. This is because transfers across all the agents

[11] The right-hand side of that equation comes from aggregating the labour demand given by (35) at the sector level.

in this economy, aimed at compensating them for eventual losses due to movements in prices, are assumed to be allowed.

Indeed, I have to explain such an inefficiency and how the integrated and the labour restricted settings differ in terms of distance from the Social Planner solution. Thus, the inefficiency is simply explained by the fact that in both the competitive market models, in case of heterogeneity of intra-industry demand elasticities, the marginal rate of substitution between any two intermediate goods, say 1 and 2, that is the amount of good 2, Y_2, that the consumer must be given in order to compensate her for a one-unit marginal decrease in the consumption of good 1, Y_1, is different from the marginal rate of transformation, that is the rate at which they can be transformed into each other[11] Therefore, suppose that there are only two industrial sectors, 1 and 2 and, particularly, the two sectors differ by demand elasticity, that is:

$$\rho_1 \neq \rho_2.$$

As I said above, in order to have an efficient allocation, it must be:

$$MRS_{Y_1,Y_2} = MRT_{Y_1,Y_2}.$$

On the one hand, the Marginal Rate of Transformation (MRT) is equal to:

$$MRT_{Y_1,Y_2} = \frac{\theta_2}{\theta_1}.$$

On the other hand, the Marginal Rate of Substitution (MRS) takes on different values according to the economy I set up. Particularly, in case of integrated economy, the MRS is equal to

$$MRS_{Y_1,Y_2} = \frac{\rho_2\theta_2}{\rho_1\theta_1}.$$

So, as evident, there is a wedge between the MRT and the MRS, that is given by the intra-industry demand elasticities ratio, ρ_2/ρ_1.[12] Where does that wedge come from? It actually depends on the asymmetry in monopoly power across sectors. As long as producers have got some monopoly power, the marginal cost of production will be lower than the product price by the markup.[13] The larger the markup, the larger the gap between marginal cost and price of the produced good. If demand elasticities are heterogeneous, then production resources will tend to be overallocated within those sectors where the demand elasticity is lower, that is where the gap between marginal cost and price is relatively lower. However,

[11] See Adao, Correia and Teles (2003) and Bilbiie, Ghironi and Melitz (2008) as references for inefficient allocations of input factors.

[12] Indeed, if $\rho_2 = \rho_1$, then the wedge disappears and we turn to an efficient allocation.

[13] See also Epifani and Gancia 2011 as a reference for inefficient allocation cases.

as Lerner (1934) argued, when markups are homogeneous, their distorting effect vanishes.

Instead, in case of labour segmented economy, the MRS turns out to be different from the previous case:

$$MRS_{Y_1,Y_2} = \left(\frac{\rho_2^{\gamma} \theta_2 \overline{L}_2^{1-\gamma}}{\rho_1^{\gamma} \theta_1 \overline{L}_1^{1-\delta}} \right)^{\frac{1-\delta}{1-\gamma\delta}}.$$

Thus, the MRS is not only a function of both the relative productivity and the relative demand elasticity, but also of the exogenous sector-level labour allocation. Intuitively, this might lead to an improvement in terms of efficiency as the distortion implied by the demand elasticity ratio might be, even partially, compensated by the distortion given by the ratio of sector-level labour supplies, if they go to the opposite direction. For example, demand elasticity in sector 1 is larger than demand elasticity in sector 2, then it will result there is overallocation of production resources into sector 1; however, such overallocation can be mitigated if the exogeneous labour allocation in sector 1 is lower than the exogeneous labour allocation in sector 2 (assuming that industry level aggregate productivities are the same).

Particularly, if exogenous labour allocation matches the Social Planner allocation, it results that in the labour segmented context, the marginal rate of substitution between Y_1 and Y_2 will be:

$$\begin{aligned} MRS_{1,2} &= \left(\frac{\rho_2}{\rho_1} \right)^{\alpha} \frac{\theta_2}{\theta_1}, \\ \text{where } \alpha &= \frac{\gamma(1-\delta)}{1-\gamma\delta}. \end{aligned}$$

As long as the power to which the demand elasticities ratio is raised is lower than one, that is

$$\alpha < 1,$$

the gap between MRS and MRT is lower than in the integrated economy:

$$\left(\frac{\rho_2}{\rho_1} \right)^{\frac{\gamma(1-\delta)}{1-\gamma\delta}} < \frac{\rho_2}{\rho_1}.$$

So doing, even though I can not turn to the first best solution, an exogeneous distribution of labour across industrial sectors can be Pareto improving with respect to the fully integrated market solution. Furthermore, it is also possible to notice that

$$0 < \frac{d\alpha}{d\gamma} = \frac{1-\delta}{(\gamma\delta - 1)^2} < 1,$$

that is the larger the output elasticity of capital, i.e. γ, the larger α, and then the relatively farer I am to the first best solution (i.e. $\alpha = 0$). In conclusion, when ρ_1 is larger than ρ_2 , there is overallocation of both capital and labour within sector 1: by labour segmentation, I can exogenously withdraw labour from that sector and move that to sector 2 (where it was originally underallocated), so as to reduce the overallocation of labour. In particular, the lower the output elasticity of capital γ, i.e. the lower the contribute of capital to production, the more effective labour restriction will be in the direction of a first best allocation of input factors.

3.4 An application of the model to international labour market integration.

3.4.1 Comparative statics

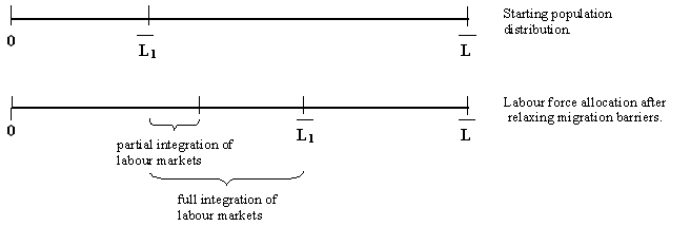
In order to exploit my model to analyze the effects of relaxing barriers to international migration and, particularly, to compare different distributions of labour force across countries, I first need to redefine sectors as countries. I can do that by using the Armington assumption, according to which goods coming from different places are imperfect substitutes. Thus, under monopolistic competition, each country specializes in a particular set of goods.

Several works actually rely on this assumption (see Anderson, 1979 and Bergstrand, 1989). More recently, Galì and Monacelli (2005) assumed imperfect competition between goods coming from different countries within a small open economy model setting optimal monetary policy. Furthermore, Epifani and Gancia (2009) also made some examples to justify the use of that within their model and to explain that prices charged by exporters do not have to be takes as given. The first example is that of Madagascar, that is an exporter of vanilla: as long as Malagasy vanilla is world-wide regarded as of higher quality, vanilla exporters from Madagascar have some market power. Furthermore, the Finnish Nokia mobile phones and the American Motorola ones are not perceived as the same, so that even exporters from a small country such as Finland do have some market power and are able to impose domestic taxes affecting the prices of their goods on foreign consumers.

Furthermore, there is evidence for Europe that consumer bias can explain border effects on international trade better than no-tariff barriers. Head and Mayer (2000) reported that, on average, Europeans were buying from domestic producers 14 times more than from foreign producers placed at same distance; moreover, the tariff equivalent of the border (in 1984-1986) was estimated at around 37 percent. Thus, they evaluated the measures included within Europe's Single Market Programme, that were aimed at reducing market fragmentation across the European area by reducing non-tariff barriers. They did that by setting a monopolistic competition model and estimating border effects for 3-digit

industries in the European Union. What they found is that there is a poor relation between market fragmentation and such barriers and pointed to consumer bias as the main explanation for market fragmentation and border effects. Furthermore, Anderson and Van Wincoop (2003) estimated a gravity model with CES preferences to disentangle the "McCallum border puzzle". Particularly, they assumed that products are differentiated by place of origin. They mainly found that national borders are able to reduce trade between industrialized countries by 20-50 percent.

So, suppose that the world economy features only two countries, that are imperfect substitutes by Armington assumption. Moreover, the market of the homogeneous final good, that is produced by combining the outputs of the two countries, is assumed to be fully integrated. In addition, in each of the two national markets, there is a large number of monopolistically competitive sectors, that are heterogeneous by productivity. Production requires two input factors: labour and capital. Capital is assumed to be free to cross the borders. Instead, labour force is initially assumed to be constrained at the original population level, because of immigration barriers. Thus, I wish to exploit my framework to illustrate the effects of relaxing such immigration constraints and, more specifically, to compare different cross-country allocations of labour force through some simple numerical exercises, whose mechanics is explained in the following Figure 3.2:



Mechanics of comparative statics

Notice that it is possible to observe the production outcome of the whole economy not only at the original population level in the two countries and in the fully integrated context, but also at points in which labour mobility has been only partially allowed. This is because I consider the outcomes coming from all the possible distributions of labour

across the two countries in a labour segmented economy (given that no country can be empty).

Thus, I aim at comparing two different scenarios: in the first one, producers in the two countries are similar in terms of both monopoly power and productivity; particularly, I assume there is the same number of producers and the same distribution of productivities among them. Therefore, countries can only differ by size (i.e. the population amount). In the second case, instead, producers in the two national markets differ by monopoly power, but keep being similar in terms of productivity.

First, I want to show how total income changes for different distributions of population across the two countries according to the two different scenarios. Particularly, in each of the two countries, before integrating the respective labour markets, the population can be lower, equal or larger than the labour force allocated after relaxing immigration barriers. Thus, depending on the starting position of the population with respect to the integrated market allocation of the labour force, countries will deal with migration inflows, if the population size is lower than the labour force amount dictated by the market within the integrated setting, or migration out-flows, in the opposite case. Thus, I am going to illustrate the welfare outcome both at the global level and at individual country level.

Then, I am turning to the effects of cross-border labour movements on the three components of total income, that are capital income, labour income and profits. In more detail, in a labour restricted economy, capital income also changes according to the population distribution as the latter affects the interest rate equilibrium.[14] In addition, the effects of relaxing migration barriers on labour income also change according to the distribution of population across the two countries. In fact, when migration flows are constrained, wages can be different across countries: *ceteris paribus*, the larger the population, the lower the average wage. Therefore, when barriers are set off, labour movements make the wages of the two countries equalize: of course, the equalized wage will turn out to be higher than the starting wage for the country coping with migration outflows and lower for the country facing migration inflows. However, the impact on labour income at the individual country level must also take into account remittence that emigrants send back to their original country.

Finally, the effects on profits are not trivial. First, it must be reminded that firms can not change location; thus, what can actually change is only the distribution of input factors across firms, sectors and the two countries. Furthermore, it is worth highlighting that when labour moves from one country to the other one, it is also followed by capital as the latter is, at a certain degree, its complementary production factor. Indeed, moving production factors from one country to the other one increases the output of the latter;

[14] I assume capital ownership to be equally shared by the two countries as, at this stage, I prefer focusing on population asymmetries.

moreover, it also affects input costs and prices, so that the final outcome in terms of profits might be ambiguous.

Thus, I am going to present the results of the numerical exercises, in order to try to address some of the issues raised so far. First of all, in Figure 3.3, I compare the aggregate economy outputs in the two scenarios: in the first one, the demand elasticity is the same across the two countries (i.e. $\rho_1 = \rho_2 = 0.55$), while, in the second one, country 1 is assumed to be more competitive with respect to country 2 (i.e. $\rho_1 = 0.8, \rho_2 = 0.55$). On the horizontal axis, I measure the amount of population in country 1, $\overline{L}_1$, while on the vertical axis I represent the total income at the aggregate level. Particularly, notice that $\overline{L}_1$ is assumed to be strictly larger than zero and strictly lower than $\overline{L}$, that is the sum of the population sizes in country 1 and country 2; this is because I assume no empty countries. Thus, for each scenario, I compare the outcome in three different frameworks: the fully integrated economy, where both capital and labour are free to cross national borders; the labour restricted economy, where labour force is constrained at the population size while capital is still assumed to be free mobile across countries; the social planner economy, that provides the first best solution. So, in the first scenario, I can observe that the total outcome reached by a completely integrated economy exactly matches the first best solution by the Social Planner. Particularly, the endogenous labour force allocation according to the fully integrated economy, L_1, is equal to the labour force allocation according to the Social Planner, L_1^*. Furthermore, the labour constrained economy can also produce as much aggregate output as the Social Planner does, when the population size in country 1 matches the optimal labour force allocation. Turning to the second scenario, in this case, it results that the integrated economy is not able to catch the first best solution. In fact, the endogenous labour force allocation in country 1 according to the competitive economy does not match the optimal allocation by the Social Planner. In more detail, the competitive integrated economy allocates more labour force in country 1 than how much the Social Planner would do; this is because, as I should in the theoretical part before, in case of asymmetric demand elasticities, production resources will result to be overallocated within the relatively more competitive markets. However, it seems that, in this scenario, the labour segmented economy can, for some exogeneous distributions of population across the two countries, perform better than the integrated one even though it is also unable to reach the optimal solution. Indeed, a partially segmented market can actually yield a Pareto-improvement when the population size is equal to the optimal labour force allocation. However, as I explained in the theoretical part, this economy will not catch the first best as long as the capital keeps being free mobile across countries and deal with the distortion implied by the demand elasticity heterogeneity. Of course, the two competitive economies produce the same aggregate output when the population size in country one is equal to the endogenous labour force allocation according to the

integrated economy. Thus, I can also distinguish cases in which labour integration is worth and cases in which it is not. In particular, if the population size in country 1 is larger than the endogenous labour force allocation according to the integrated market, then integrating labour markets results to be worth, as it leads the economy to larger levels of production; however, if the population size in the first country is in between the optimal allocation and the endogenous allocation, then integration decreases the final output. Finally, if the population living in country 1 is lower than the optimal allocation of labour force according to the Social Planner, integration can be either Pareto-improving or Pareto-worsening, depending on the original amount of country 1 inhabitants.

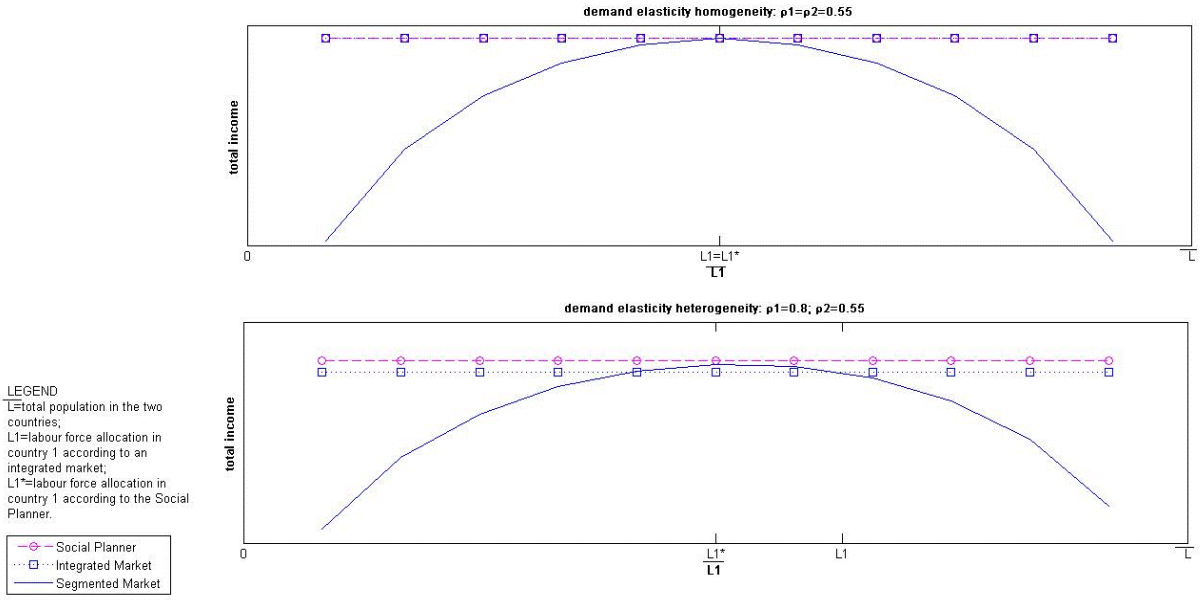


Figure 3.3. Total income

Turning to Figure 3.4, it describes the partial components of the total income at the aggregate level in the two different scenarios. In more detail, it shows how much firms, capital owners and workers earn in aggregate terms both when the economy is fully integrated and when labour force is constrained at the population size. Thus, I report the outcome of three variables for different distributions of the population across the two countries: total profit, that is the sum of the profits earned by all the firms in the whole economy; total labour income, that is the sum of the labour income of country 1 population and the labour income of country 2 population; total capital income, that is the aggregate rental rate by the aggregate capital stock. So, if demand elasticities are homogenous (i.e. $\rho_1 = \rho_2 = 0.55$ in my numerical example), it comes out that a restricted economy is never better than an integrated one for anybody (i.e. firms owners, workers and capital owners). However, if the population distribution across the two countries exactly matches the endogenous distribution of the labour force (that, in this case, also equals the first best

allocation, i.e. $L_1 = L_1^*$), then all the three components of total income (profits, labour income and capital income), in aggregate, are equal in both the scenarios. However, in the second scenario, where country 1 relative demand elasticity ($\rho_1 = 0.8$) is larger than country 2 relative demand elasticity ($\rho_2 = 0.55$), labour constrained economy can perform better than the fully integrated economy for everybody: firms owners, workers and capital owners. Indeed, if the population size in country 1 ($\overline{L}_1$) is equal to the endogenous allocation of labour force in the same country (L_1), total profits, total labour income and total capital income are equal in the two scenarios. Furthermore, if $\overline{L}_1$ is larger than L_1, then firms owners, workers and capital owners would be strictly better off in an integrated context; in the opposite case ($\overline{L}_1 < L_1$), instead, they can be either better off or worsen off, depending on the population size.

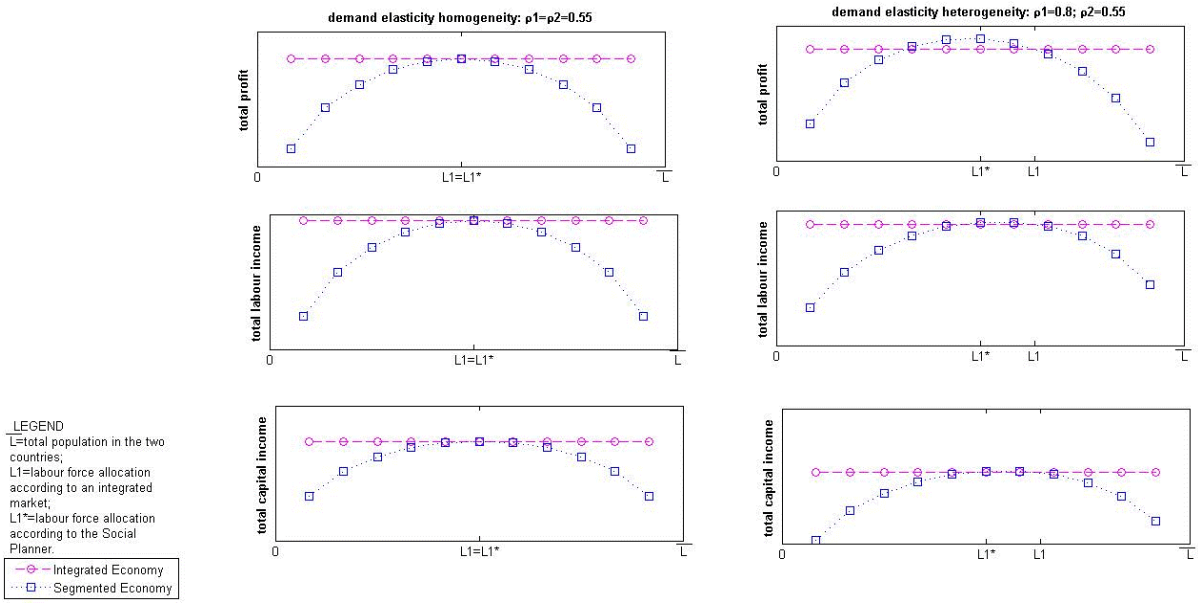


Figure 3.4. Total profit, labour income, capital income

Next, turning to Figure 3.5, I show how input factor prices change for different population distributions in the two different scenarios. First of all, it might be worth reminding that if labour force is constrained at the population level, then average salaries can differ across the two countries; in an integrated context, instead, wages in the two national markets equalize. Indeed, rental rate is always unique across the two countries, as capital market is integrated in both the competitive economies that I am studying. Thus, in the first scenario, where within-country demand elasticities are the same (i.e. $\rho_1 = \rho_2 = 0.55$), both average wage in country 1 and average wage in country 2 in the labour segmented economy, are equal to the cross-country common wage in the integrated economy, if population distribution matches the endogenous labour force allocation according to the integrated context (in turn, the latter is equal to the first best allocation, i.e. $L_1 = L_1^*$), that

is $L_1 = \overline{L}_1$. Moreover, the larger the population in country 1, $\overline{L}_1$, the lower the average wage in that national market in case of labour segmented market. So, on the one hand, if population in country 1, $\overline{L}_1$, is lower than the endogenous allocation of labour force in that market according to the integrated economy , L_1, then the constrained market wage in country 1 is larger than the equalized wage in the integrated market; on the other hand, if $\overline{L}_1$ is larger than L_1, then the labour restricted economy wage in country 1 is lower than the cross-country common wage after integration. In terms of country 2, the opposite turns out to be true: if $\overline{L}_1$ is lower than L_1 (that is actually equal to L_2 as the two countries are assumed to be perfectly symmetrical by both aggregate productivity and demand elasticity), then $\overline{L}_2$ (that is equal to the total population, $\overline{L}$, minus $\overline{L}_1$) will be larger than L_2 (that is equal to the total aggregate labour force, $\overline{L}$, minus L_1) and then the restricted market average wage in country 2 will be lower than the cross-countries equalized wage after labour integration; instead, if $\overline{L}_1$ is larger than L_1, then $\overline{L}_2$ is lower than L_2 and the labour restricted economy wage in country 2 will result to be larger than the common wage in the integrated economy. About the rental rate, capital price in a labour constrained economy is never larger than a fully integrated economy; nevertheless, the two competitive economies yield the same value of rental rate if the population distribution across the two countries is perfectly equal to the endogenous labour force distribution according to the integrated market (and to the Social Planner too). In the second scenario, where the demand elasticity in country one, ρ_1, is larger than the demand elasticity in country 2, ρ_2, the amount of labour force endogenously allocated in country 1 (L_1) is larger than the optimal amount (L_1^*). Therefore, on the one hand, as before, the constrained market specific wage in country 1 will cross the equalized wage after integration in correspondence of L_1 that, in this case, is larger than L_1^*. On the other hand, in the labour constrained economy, country 2 wage will cross the integrated economy common wage for a value of L_2, that is lower than the social planner allocation of labour force in that market (L_2^*). Indeed, this is a key result in order to understand the inefficient allocation of labour force in case of within-country demand elasticities heterogeneity: country 1 will attract an inefficient number of workers from country 2 and, in turn, country 2 will lose an inefficient number of workers moving to country 1, as the labour segmented economy relative wages in the two countries equalize in correspondence of an inefficient allocation of the labour force across the two countries. Finally, in terms of rental rate, for some distributions of population, the labour restricted economy can yield a larger capital price than the fully integrated economy. Particularly, if $\overline{L}_1$ is larger than L_1, integration leads to an increase of the capital price; however, if $\overline{L}_1$ is lower than L_1, then the rental rate might result to be either increased or decreased under labour markets integration.

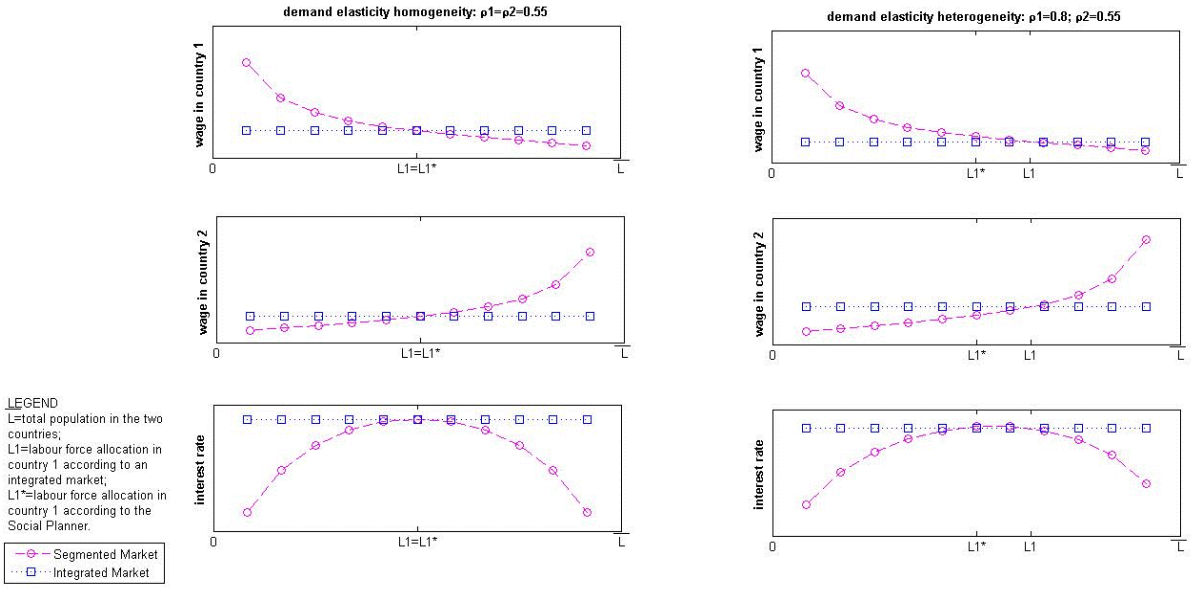


Figure 3.5. Wages and interest rate

Next, Figure 3.6 outlines how total income in the two country changes for different distribution of the aggregate population, when full labour mobility is allowed. In the first scenario, country 1 gains when markets are integrated if its population, $\overline{L}_1$, is larger than the labour force allocated under an integrated economy, L_1 (that, as I said, matches the optimal allocation in this case). Instead, if $\overline{L}_1$ is lower than L_1 , then country might either gain or lose by letting foreign workers in their market. On the other side, if country 2 has got a population size, $\overline{L}_2$, that is lower than L_2, then it will lose from integration. Instead, if $\overline{L}_2$ is larger than L_2, than country 2 total income could be either better or worse off. Then, turning to the heterogeneous demand elasticities case (i.e. $\rho_1 = 0.8$ and $\rho_2 = 0.55$), as in the previous case, country 1 gains from integration if its population, $\overline{L}_1$, is larger than L_1. However, as L_1 is larger than the optimal allocation of labour force (L_1^*), $\overline{L}_1$ will have to be larger than before in order to make the integrated economy worth. Instead, if $\overline{L}_1$ is lower than L_1, then country 1 seems to always lose in case of full mobility of input factors. On the other hand, country 2 will gain from integration even for a population size, $\overline{L}_2$ that is lower than in the first scenario: if fact, as the demand elasticity in country 2 is relatively lower than that in country 1, the labour force endogenously allocated, L_2, will be lower than the optimal amount, L_2^*. However, if the population size is lower than L_2, then country 2 might either gain or lose in case of labour markets integration.

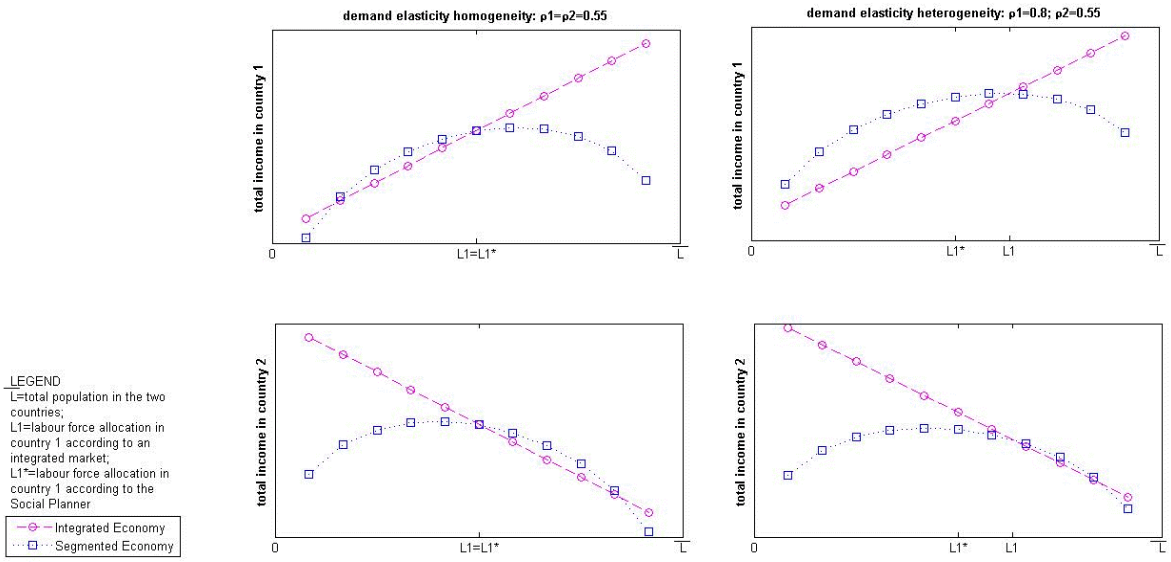
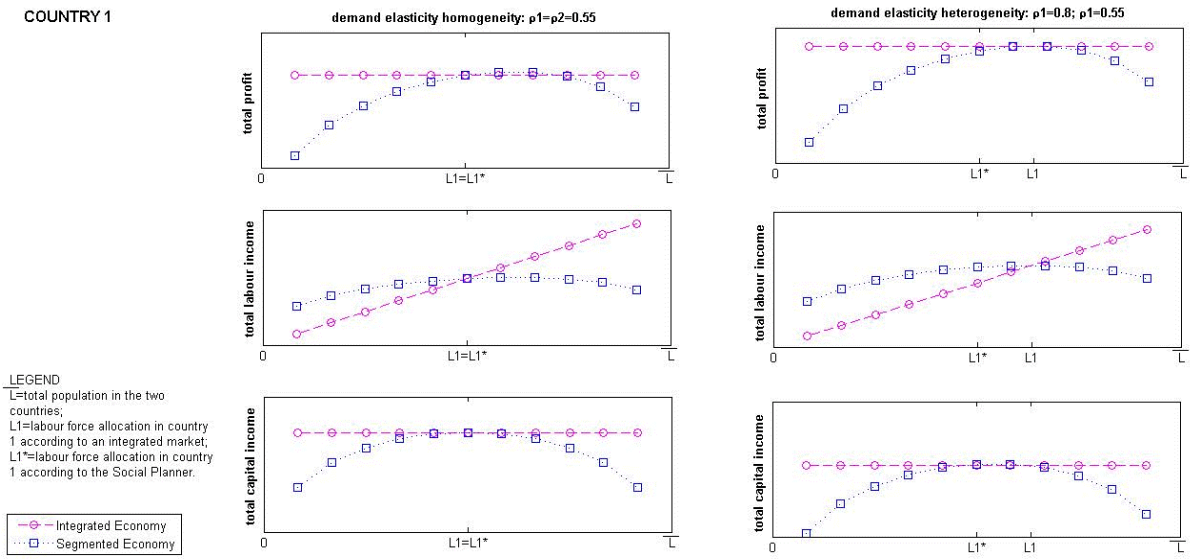


Figure 3.6. Total income in each country

Finally, by Figures 3.7 and 3.8, I try to give more details about gainers and losers from integration at the individual country level. Particularly, in this case, I distinguish between profits earners, workers and capital owners (recall that I assume capital ownership equally shared between the two countries). So doing, I am possibly going to make what has been seen in Figure 3.6 clearer. As usual, I first look at the homogeneous demand elasticities scenario. Thus, starting from country 1 (Figure 3.7), this, as I saw before, will turn out to be better off in case of integration if the population, $\overline{L}_1$, is larger than L_1. Particularly, this means that when labour is allowed to be free mobile across borders, workers will move out of country 1 towards country 2. Thus, country 1 wages will result to be increased (see Figure 3.5) and who keeps staying and working in that country will gain. Moreover, capital owners can never be worse off in the perfectly integrated market, as the maximum interest rate in a segmented economy is equal to the rental rate in an integrated economy (see Figure 3.5); as that maximum value is reached when the population distribution matches the endogenous labour force allocation under integration, then if $\overline{L}_1$ is larger than L_1, then capital owners will also gain. Nevertheless, profits' path is not as linear as both capital income's and labour income's. In fact, as seen in Figure 3.5, the larger the population, $\overline{L}_1$, the larger the (positive) gap between the integrated economy specific remuneration of input factors and the segmented economy relative wage/rental rate. This means that, for very large $\overline{L}_1$, integration would yield to a big increase in the production costs, so as to make integration detrimental for country 1 in terms of profits. On the other side, for population size that are lower than L_1, the labour force in country 1 will lose in an integrated economy context as wages will be pushed down by immigration inflows. Nevertheless, capital owners

will gain even in this case, such as profit earners that will enjoy lower labour costs. In the second scenario (i.e. $\rho_1 > \rho_2$), for $\overline{L}_1$ larger than L_1 (that, in this case, is larger than the optimal allocation of labour force in country 1, L_1^*), profit earners, wage earners and capital owners are better off by relaxing immigration barriers. Thus, by reducing the labour force in country 1 (as part of the population will move to country 2), wages will turn out to be increased so as to make workers in that country gain and rental rate will also increase. However, in this case, the increase in the production costs do not make profit earners necessarily lose: the possible amount of migration outflows is lower as the labour force endogenously allocated in country 1 is larger (because of relatively larger elasticity of demand). Thus, the consequent increase in labour costs as an effect of dropping migration barriers is lower than in the first scenario, so that it will not overturn the positive effects on the revenues from a larger demand of the country 1's intermediate good in an integrated economy. In turn, if the population in country 1, $\overline{L}_1$, is lower than L_1, then integration will be detrimental for workers as migration inflows will make wages decrease. Capital owners will be either better or worse off: for a population size not so far from the the labour force allocation in country 1 in an integrated economy, the rental rate in a labour restricted economy will be larger than migration unconstrained framework. Furthermore, the closer $\overline{L}_1$ to L_1, the lower the (positive) gap between the restricted economy specific wage and the labour integrated economy relative wage, the lower the gain of country 1' profit earners from integration. Turning to Figure 3.8, the latter shows that in country 2 the paths of capital income, labour income and profits when free labour mobility is allowed for. In case of the first scenario, what I said before for country 1 also holds for country 2, as I assume perfect symmetry between the two countries. In case of heterogeneity in demand elasticities (i.e. $\rho_1 = 0.8$ and $\rho_2 = 0.55$), instead, I can say something more. In fact, in this case, the labour force allocated in country 2 after integration is lower than the optimal amount (as country 2 is relatively less competitive than country 1). Thus, dropping migration constraints will yield that wages be either increased, if $\overline{L}_2$ is larger than L_2, or decreased, in the opposite case. In terms of capital income, it will follow the path of rental rate described in Figure 3.5: if $\overline{L}_2$ is lower than L_2, then country 2 capital owners will gain from integration; if $\overline{L}_2$ is larger than L_2, than they can be either better or worse off. Particularly, if $\overline{L}_2$ is not so larger than the labour force endogenously allocated in country 2, L_2, then capital owners will be better off in a segmented economy; otherwise, that is $\overline{L}_2$ much larger than L_2, capital income will be larger in an integrated framework. Finally, turning to profit earners, differently from the country 1's case, they can be worse off in case of labour integration, if $\overline{L}_2$ is larger than L_2. In fact, labour integration leads to a suboptimal allocation of labour force in country, that consequently produces too little. Therefore, if $\overline{L}_2$ is larger than L_2 and the labour force is constrained at the population level, then country 2 production will increase, turning closer to the efficient level. However,

for a very large size of $\overline{L}_2$, profit earners will result to be better off in an economy without constraints to migration flows.



Profit, labour income, capital income in country 1

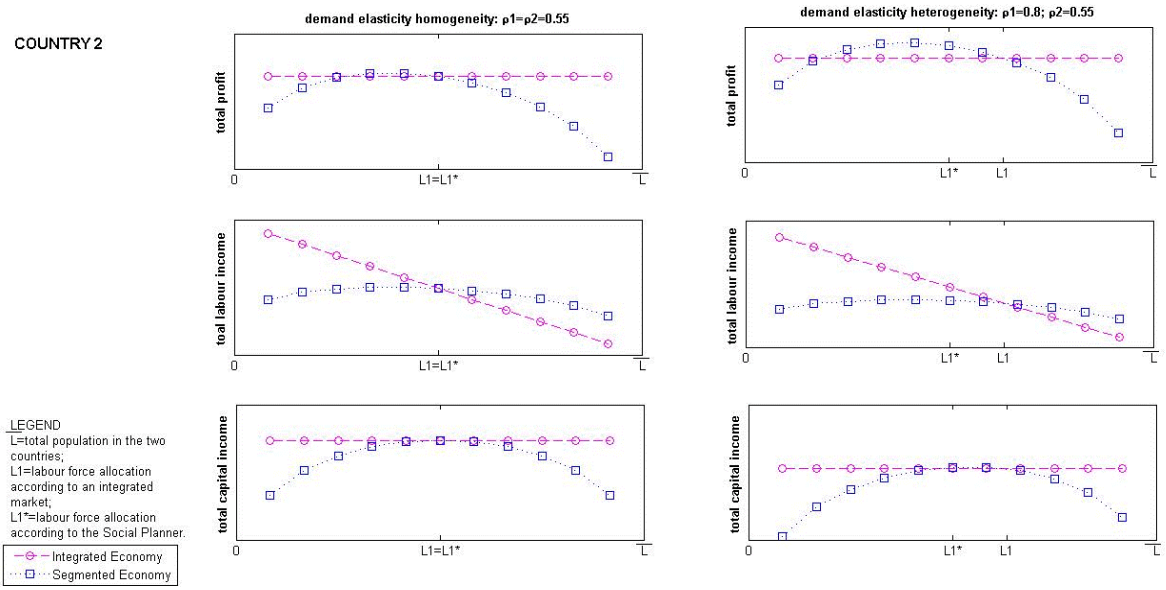


Figure 3.8. Profit, labour income, capital income in country 2

3.4.2 The European Union case

Since the Treaty of Rome (1957) that established the European Community, the free movement of workers was a cornerstone of the European Union. In fact, article 39 of

that agreement gave member countries' workers several rights to ensure as much mobility of workers as possible across the European area, such as the right to look for a job, to work, to reside and to remain in another member country; particularly, that article also guaranteed European workers the right to equal treatment in terms of access to employment and working conditions in order to enhance the integration of immigrants with the host country's workers.

Immigration paths across European Union after enlargements

It might be worth to see what happened in terms of immigration movements around the European Union after the latest enlargements, especially to the Eastern Europe countries. This is because most of the candidate members, namely Croatia, Iceland, Macedonia, Montenegro, Turkey, are placed in the east part of Europe. Therefore, I might use those data to make some (rough) predictions about expected migration patterns after an eventual further enlargement of the European Union to those countries. The major aim is to possibly evaluate whether misallocation issues I have theoretically raised before can be somehow realistic and plausible with respect to the actual case of the EU size. Zaiceva and Zimmermann (2008) found an increase in immigration from countries which entered the Union in 2004, namely Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia into most of EU-15 countries.[15]Particularly, most of the inflows were actually coming from Poland. Focusing on the specific case of Germany, Brenke, Yuksel and Zimmermann (2009) found that, despite of some restrictions imposed to both workers and companies from the "EU-8" countries, the net inflow of immigrants from those countries after enlargement (2004) had become 2.5 times larger than in the past four years. Turning to the Swedish case, Wadensjö (2007) showed that, although an increase in immigration is already evident since the first years of 2000s, it became much larger after 2004. Furthermore, inflows from EU-8 countries resulted to be larger than outflows, so highlighting one clear direction for migration movements. Finally, even for Sweden, most of immigrants came from Poland, followed by Baltic countries. Kaczmarczyk and M. Okólski (2008) reported a significant increase in migration outflows from Poland and Baltic states, after the 2004 enlargement, especially towards Ireland and the UK. The UK, along with Ireland and Sweden, was a particular case as, differently from the other "old members" of the European Union, they decided to not impose any restriction to migration inflows from the new member countries from the beginning. Thus, Gilpin, Henty, Lemos, Portes and Bulle (2006) also showed that the number of immigrants from the EU-8 countries to the United Kingdom rose after the agreement. Turning to the specific case of Ireland, Doyle, Hughes and Wadensjö (2006) reported an increase in the number of foreigners between 2003 and 2005, and the majority in 2005 were from the new member states. Barrett and

[15]They are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

McCarthy (2008) found that immigrants form the new member states constituted three percent of the whole Irish population in 2006.

Moreover, in terms of the countries where migration flows depart from, the World Bank (2006) documented that Lithuania had got the largest emigration rate among the new member countries: 3.3 percent of its population emigrated straight after the enlargement agreement. Lithuania is then followed by Latvia, with 2.4 percent of emigrants, and Poland, with one percent. Particularly, the WB report highlights the fact that the major destination countries were Germany and the UK.

Entry barriers in the current EU members and in the candidate members

One of the crucial points that I make in this chapter is that heterogeneity in competitiveness across markets can generate misallocation problems, namely overallocation of production resources within relatively more competitive markets and underallocation of resources within relatively less competitive markets. So, I argue that if markets that compete within a perfectly integrated context differ by markups, then I can expect an excess of movements of input factors towards the more competitive areas. Consequently, the latter will produce "too much", while the areas that face outflows will produce "too little".

As studied in Aghion, Harris, Howitt and Vickers (2001), the degree of market competitiveness can depend on the entry barriers that prevent new competitors from entering the market and competing with the incumbents. Of course, such entry barriers might crucially depend on institutional and political factors, that affect the market structure. More specifically, such barriers can concern both product market regulation and sectoral regulation.

So, in order to give a quantitative idea about how they can (sometimes) heavily differ across countries within the European area, I exploit the OECD database. The latter provides *Indicators of Product Market Regulation,* that "are comprehensive and internationally-comparable set of indicators that measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable". In more detail, those indicators concern formal regulations in the following areas: legal and administrative barriers to entrepreneurship; barriers to international trade and investment and state control of business enterprises.[16]In addition, the OECD database contains cross-section *Indicators of Sectoral Regulation*, that measure concern regulatory conditions in the both the professional services and the retail distribution sectors. In particular, the professional services indicators are about entry and conduct regulation in the legal, accounting, engineering and architectural professions. Finally, the same database also provides *Indicators of Regulation in Energy, Transport and Communications.* The lat-

[16]However, OECD alert that because of some fast reforming countries, the actual situation might not be fully reflected by those data.

ter concern regulatory provisions in the following sectors: telecoms, electricity, gas, post, rail, air passenger transport and road freight. Thus, I report all the analytical indicators of Product Market Regulation (Table 3.1) and the analytical indicator of regulation of the retail market, along with two synthetic indicators of, respectively, the entry/conduct regulation in all professional services and the regulation in energy, transport and communications (Table 3.2). In more detail, I show the values of those indicators at the latest available year, that is 2008 for all of them, except for the Indicators of Regulation in Energy, Transport and Communications, for which the latest year available is 2007.

Aiming at evaluating the actual effects of the latest EU enlargements and, possibly, the potential effects coming from the access of some of the EU candidates, I report entry barriers data about three sets of countries: EU-15, that are the EU state members before the enlargement in 2004 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden, UK); EU-8, that are those countries that entered the EU in 2004: Czech Republic, Estonia, Hungary, Poland, Slovakia, and Slovenia[17]; EU candidates, that are Iceland and Turkey.[18] Indeed, I would also include in the analysis the other two countries that joined the EU in 2004 so called "EU-2", that are Cyprus and Malta, along with Bulgaria and Romania that entered the Union in 2007, but no data are currently available. Therefore, the idea is that by comparing the market structures of the latest countries that entered the EU with those of the EU state candidates, I might formulate some (even rough)expectations about migration flows that a further EU enlargement could lead to.

Thus, looking at the Table 3.1 below, I can compare the values of the indexes of Product Market Regulation for the different sets of countries selected. First, in terms of legal and administrative barriers to entrepreneurship, the average value of the index for EU-8 countries (1.601) is definitely larger than that for EU-15 state members (1.242). Within the EU-15 group, the countries with the largest values are Greece, Luxemburg and Belgium (respectively, 1.953, 1.696 and 1.428), while the state members with the lowest values are UK, the Netherlands, Sweden (respectively, 0.824, 0.871 and 0.959). Within the "EU-8" set of countries, instead, the country with the largest value is Poland (2.323), followed by Hungary (1.702), Czech Republic (1.55) and Slovakia (1.545). Finally, within the member candidates, Turkey has actually got an index value (2.436) that is much larger than the largest values in the other two groups, while Iceland's value is equal to 2.001.

Next, I turn to the second index of product market regulation, which concerns barriers to trade and investment. Even in this case, the EU-8 group's average value (0.863) is far larger than the EU-15 one's (0.561). On the one hand, among the EU-15 group, the

[17]The list of the eight countries would be complete if I also included Latvia and Lithuania. However, no data about those two countries are available (as they do not belong to OECD).

[18]Even in this case, the remaining countries that would complete the list (Croatia, Macedonia, and Montenegro) are currently missing in the data.

countries with the largest values are Greece (1.323), Austria (1.163) and Italy (0.717), while the states with the lowest values are really far from the first ones: UK (0.199), Ireland (0.317) and Belgium (0.318). On the other hand, the EU-8 countries with the largest index value are: Slovakia (1.731), Poland (1.117) and Czech Republic (0.88). Moreover, within the member states, Turkey's value (0.823) can be placed in within the largest values of the EU-15 group, while Iceland's value (0.155) is within the lowest ones (actually it seems that in Iceland barriers to trade and investment are even lower than in the UK).

Finally, in terms of the latest index, concerning the state control, EU-8 countries seem to be facing larger barriers than EU-15 ones: in fact, for the first group the average index value is 2.327, while for the second one, the average value is 2.138. Among the original EU member states, the largest values are for Greece (3.847), Portugal (2.651) and France (2.616), while the lowest ones are for the Ireland (1.271), Denmark (1.371) and the UK (1.504). Within the countries that entered the EU in 2004, instead, those with largest values are Poland (3.352), Slovenia (2.647) and Czech Republic (2.434). Finally, turning to the EU candidates, Turkey has got a very large (only slightly lower than the Greek one), that is 3.793, while Iceland has got an index value (0.854) that is actually lower than the lowest one in the EU-15 group.

In summary, in terms of product market regulations, among the EU-15, the largest barriers are in Greece, that has got the largest values for all the three indeces analyzed so far. Instead, the lowest barriers are the in the UK and Ireland. Thus, on the one hand, the new member states seem to have, on average, larger barriers than the original members; in particular, the countries with the largest barriers are Poland and Czech Republic. Within the candidate members, on the other side, Turkey's indeces values always exceeds the EU-15 average values and can be generally placed in within the top values of both the old and the new members. On the other hand, Iceland has got very low barriers; particularly, they result to be always lower than the EU-15 members' lowest ones.

Table 3.1. Product Market Regulations

	Entrepreneurship	*Trade and investment*	*State control*
EU15			
Austria	1.178	1.163	2.015
Belgium	1.428	0.318	2.533
Denmark	1.15	0.649	1.371
Finland	1.36	0.451	1.752
France	1.284	0.464	2.616
Germany	1.315	0.712	1.958
Greece	1.953	1.323	3.847
Ireland	1.165	0.317	1.271
Italy	1.081	0.717	2.333
Luxemburg	1.696	0.472	2.51
Netherlands	0.871	0.329	1.708
Portugal	1.17	0.459	2.651
Spain	1.202	0.278	1.621
Sweden	0.959	0.568	2.378
UK	0.824	0.199	1.504
average	1.242	0.561	2.138
EU8			
Czech Republic	1.55	0.88	2.434
Estonia	1.402	0.524	2.011
Hungary	1.702	0.285	1.905
Poland	2.323	1.117	3.352
Slovakia	1.545	1.731	1.612
Slovenia	1.083	0.643	2.647
average	1.601	0.863	2.327
EU candidates			
Iceland	2.001	0.155	0.854
Turkey	2.436	0.823	3.793
average	2.218	0.489	2.323

Source: OECD database

Thus, I now turn to the second category of entry barriers indeces, that concern sectoral regulation. I first look at the data about the index that measures regulatory conditions in professional services. It comes up that, on average, EU-15 countries have got much lower barriers (1.967) with respect to the new members (2.634). Particularly, among EU-15 state members, the countries that report the largest values for that index are: Luxemburg (3.536), Italy (3.234), Germany (2.852) and Greece (2.809); instead, the countries with the

lowest values are: Sweden (0.6), the UK (0.735) and Ireland (0.864). On the other side, within EU-8 countries, those reporting largest index values are Slovenia (3.33), Hungary (3.144) and Poland (2.658). Finally, regarding the candidate members, Turkey's index value is definitely larger than the averages values of the two groups of current members and only slightly lower than the largest one (in Luxemburg); Iceland, instead, has got lower barriers with respect to the average of both EU-15 members and the EU-8 ones.

Next, I describe the data about the second index, that measures toughness of entry barriers to the retail trade sector. In this case, the old EU member countries have got an average index value (2.707) that is larger than the average value for the new EU members (1.743). This means that, from the point of view of this particular sector, entry barriers are lower in EU-8 countries. Thus, on the one hand, EU-15 countries with the largest index values are: Luxemburg (4.282), Belgium (3.735), Austria (3.561) and Greece (3.488); on the othe hand, those with the lowest index values are: Sweden (0.504), Ireland (1.009) and the UK (2.032). Turning to the new EU members, those with the largest index values are: Poland (3.184), Hungary (2.105) and Estonia (1.777). Finally, about the candidate members, Turkey's value (1.544) is actually lower than the average values in the two current groups of EU members; Iceland, instead, has got an index value (2.428) that is larger than the average value for the new EU members and lower than the average value for the old members.

Finally, I turn to the third index, that measures that strictness of entry barriers for the sector of energy, transports and communications. So, in this case, the old EU member countries show an average index value (1.917) that is lower than the average value for the new EU members (2.148). In more detail, on the one hand, the EU-15 members that have got the largest values for this index are: Greece (3.07), Ireland (2.58) and Luxemburg/Portugal (2.43); on the other hand, those with the lowest index values are: the UK (0.95), Germany (1.08) and Denmark (1.22). Regarding the new EU members, those reporting the largest entry barriers to this sector are: Slovenia (2.67), Poland (2.28) and Slovakia (1.98). Last, among the candidate members, Turkey has got a really large index value (3.55), that is much larger than the largest values in both the old members and the new members groups; Iceland, instead, reports an index value (2.12) that is larger than the average value of the EU-15 group, but lower than the average value of the EU-8 group.

Summarizing, it turns out to be slightly harder than in the previous case to make conclusions about entry barriers. For both the professional sector and the energy, transport and communications sector, the new EU members show higher barriers than the old members. Particularly, among the EU-8 members, countries with the highest barriers are Poland and Slovenia. Nevertheless, in terms of the retail distribution sector, the old members result to have larger barriers than the new members. Furthermore, among the

candidate members, Turkey is far above the average indeces values in the two current EU members groups with respect to entry barriers to professions and the energy, transport and communications sector. However, in terms of barriers to the retail distribution sector, Turkey seems to have a less tough regulation of entry. Iceland, instead, has got lower barriers to the professions sector with respect to the index average values for the current EU members. Instead, it is above the average of the new member countries with respect to the retail distribution sector and above the average of the old member countries with respect to the energy, transport and communications sector.

Table 3.2. Sectoral Regulation

	All professions	*Retail trade*	*Energy, transport and communications*
EU15			
Austria	2.651	3.561	1.75
Belgium	2.183	3.735	1.85
Denmark	1.189	2.922	1.22
Finland	0.954	3.122	2.19
France	2.107	3.11	2.17
Germany	2.852	2.438	1.08
Greece	2.809	3.488	3.07
Ireland	0.864	1.009	2.58
Italy	3.234	2.614	2.01
Luxemburg	3.536	4.282	2.43
Netherlands	1.204	2.131	1.65
Portugal	2.534	3.003	2.43
Spain	2.061	2.658	1.63
SIden	0.6	0.504	1.74
UK	0.735	2.032	0.95
average	1.967	2.707	1.917
EU8			
Czech Republic	2.274	1.637	1.97
Estonia	2.111	1.777	*N.A.*
Hungary	3.144	2.105	1.84
Poland	2.658	3.184	2.28
Slovakia	2.313	0.846	1.98
Sweovenia	3.33	0.909	2.67
average	2.638	1.743	2.148
EU candidates			
Iceland	1.82	2.428	2.12
Turkey	3.385	1.544	3.55
average	2.602	1.986	2.835

Source: OECD database

In conclusion, first, in terms of product market regulation, the old EU members have got, on average, lower entry barriers than the new members, among which Poland and Czech Republic report the largest values of entry barriers indeces. Secondly, in terms of sectoral regulation, the old EU members have, on average, lower entry barriers than the new EU members with respect to the professions sector and the energy, transport and communications sector. However, with respect to the retail distribution sector, the

new members seem to have, on average, lower barriers. Thus, turning to the candidate members, it comes up that Turkey has got very high entry barriers in almost all the sectors; Iceland, instead, looks to have a not that tough entry regulation, often softer than that of the old EU members.

Therefore, the evidence reported shows that my model could catch a possible problem that the EU might have to deal with in case of further enlargement to some countries, like Turkey. In fact, on the one hand, the new EU members seem to have tougher restrictions to market competition (this does not surprise so much as most of those countries were part of the area under the Soviet influence, where a strong state control was imposed to the economy). On the other hand, large migration flows have been recorded from those countries to the old EU member countries, where entry barriers are generally lower. In particular, it came up that one of the largest outflows departed from one of the new members with the largest entry barriers to the market, that is Poland. Furthermore, favourite destinations of such migration flows are those old EU members that generally have very low restrictions to market entry, such as Germany, the UK and Ireland. Thus, even though the empirical evidence reported is really rough, it seems to support one of the issues raised through my theoretical work: if you integrate markets that are heterogeneous in terms of competition toughness, production resources might tend to (over)move towards the relatively more competitive markets. Then, my model could be helpful because it could quantitatively assess exogenous distributions of labour forces that can make asymmetric aggregates better off.

3.5 Conclusions

My work developed a study about the economic efficiency of market integration. Particularly, it focused on misallocation problems coming from integrating markets featuring heterogeneous internal competition toughness degrees. Thus, I analytically derived the equilibria in two different frameworks. The first one is characterized by full integration of both the capital and the labour markets; the second one, instead, is only partially integrated: capital is assumed to be free mobile across markets, while labour is restricted at the individual market level.

Indeed, in analytical terms, the crucial result is about the difference in production factors allocation between the labour restricted economy and the integrated economy. According to the Social Planner, input allocation only follows the relative productivity of the agents operating in the economy. Indeed, both the competitive economies that I derived are able to catch that allocation as long as demand elasticities across all the markets are the same. However, they resulted to crucially differ in case of cross-industry markup heterogeneity. In the integrated setting, industry level allocation of production factors depends not only on the relative productivity but also on the demand elasticity of

the industry: the larger the productivity and/or the larger the demand elasticity, the larger the allocation of both capital and labour. In the labour constrained economy, instead, the labour allocation in each industry is given, while the capital allocation turned out to be not only a function of both the industry specific relative productivity and demand elasticity as before, but also of the amount of labour exogenously allocated. Therefore, in the latter case, the allocation distortion implied by demand elasticity heterogeneity across industries can be (partially) corrected by labour segmentation: by constraining the mobility of labour, you can exogenously withdraw (part) of the inefficiently excessive amount of labour allocated in the relative more competitive market and move that into the relative less competitive market. Nevertheless, this resulted to be not a first best solution. The reason is that I constrain only one of the two input factors: capital keeps being free mobile even in a (partially) restricted context and, then, is distorted as well as in the integrated setting. In particular, the lower the output elasticity of capital, the more effective labour restriction will be: intuitively, the lower the contribute of capital to production, the more labour restriction will be able to work into the direction of a more efficient allocation of input factors.

Turning to the context of regional integration, one of the most relevant results from the analytical work in this chapter is that heterogeneity in demand elasticities across countries/regions can lead to an inefficient allocation of production resurces. More specifically, internationally mobile factors will over-move towards those regions with relatively larger demand elasticities and lower markups. This happens because those regions have relatively lower prices and then relatively larger real wages. Of course, the crucial assumption made here is that intra-region markups are exogenenous, as the number of firms operating within each region/country is assumed to be very large and constant. However, even allowing for endogeneous markups, i.e. they depend on the number of firms, that is determined by an entry/exit mechanism, the final result would be similar: regions with a larger price elasticity demand would be likely to comprise a larger number of firms that, in turn, would lead to a larger demand for labour and, consequently, a larger real wage. Indeed, in case of markup endogeneity, it might be interesting to study why different countries would have a different number of firms and, in turn, different markups. Thus, for example, keeping the size homogeneous across regional areas, a different amount of firms could depend on heterogeneous entry costs (see Epifani and Gancia, 2011) or heterogeneous firm-level productivity distributions. Therefore, on the one hand, asymmetric entry barriers (see Aghion, Harris, Howitt and Vickers, 2001) might depend on different institutional and political environments; on the other hand, even assuming homogeneity in entry costs, countries with relatively lower markups will be likely to have a larger number of firms that are productive enough to cover those costs and enter the market. Furthermore, another key assumption I made is the absence of aggregate scale economies via the variety

effect on productivity. Nevertheless, as long as entry is assumed to be restricted, markup homogeneity is a necessary and sufficient condition to reach a first best allocation of input factors (as shown in Epifani and Gancia, 2011.)

In order to illustrate the differences between the two settings (i.e. integrated market and restricted market), I also employed some simple comparative statics exercises. The major aim was to graphically compare the outcomes, in terms of both aggregate and individual country level income and in terms of remuneration of input factors, of a two-country economy in a constrained context and in an integrated one. In the constrained setting, labour force is restricted at the population level, while in the integrated setting, labour force can actually differ from the original population due to migration out- or in-flows. In particular, I considered two different scenarios: in the first one, the two countries have the same degree of internal competition toughness; in the second one, one country is more competitive than the other. In aggregate terms, I showed that in the first scenario a completely integrated economy yields a first best result, while the segmented economy produces as much as the one without migration constraints if the population distribution matches the labour force distribution according to the integrated market. In the second scenario, instead, the integrated economy can not yield an optimal result because of inefficient allocation of production factors. In case of exogenous restrictions to labour mobility, the economy can improve its welfare even though the result will be always suboptimal, as long as the other input factor, that is capital, is kept free to move across national borders. Going further into the analysis at the aggregate level, it came up that profits, capital income and labour income, that are the three components of the total income, can all reach larger amounts in the labour constrained economy in the demand elasticity heterogeneity case. Turning to the implication of relaxing the immigration barriers for production factors costs, of course, the first crucial result is that wages in the two countries become equal (the rental rate is always homogeneous across countries in both the settings). This will make the original populations of the two countries either better or worse off. In particular, in the country where the population is lower than the labour force allocation after integration, wages will turn out to be lowered, while in the country where the population is larger than the amount of workers allocated after dropping migration barriers, wages will result to be raised. However, the break even point, the is the point at which wages equalized, correspond to the optimal allocation of the labour force in the first scenario (i.e. demand elasticity homogeneity); instead, it corresponds to the inefficient allocation of labour, in case of cross country markup heterogeneity: the integrated market will allocate too many workers in the relatively more competitive country and too few workers in the relatively less competitive national market. Furthermore, in the first scenario, the equilibrium rental rate in a segmented context reaches the same value as in an integrated economy, if the population distribution matches the efficient distribution of labour force. However, in the

second scenario, it happens that capital owners can be better in a restricted economy if the population size in the relative more competitive economy is larger than the optimal allocation of labour force and lower than the allocation according to an integrated framework. Finally, turning to the point of view of the individual country, it resulted that, assuming the capital ownership equally distributed across the two countries, the country with a population that is larger than the labour force allocated in the integrated economy will be always better off. Nevertheless, if the population size is lower than the labour force allocated after integration, then the country can be either better or worse off. In particular, it will be worse off if the original population size is very small.

In more practical terms, one of the major scopes of this paper is to possibly contribute to the debate about integration of asymmetric markets. Of course, I mainly study integration of production factors market; however, my results might also be used in more general trade context as long as inputs factors mobility affects costs of production and, then, prices and quantities of tradeable goods. In particular, I focus on the European Union, in terms of effectiveness of both the current aggregate and the possible future one in case of further enlargements (there are already some candidate members, that are Croatia, Iceland, Macedonia, Montenegro and Turkey). Thus, I reported some data about the migration flows that followed the EU enlargement in 2004, when ten countries joined the previous fifteen members. Moreover, I tried to match those data with the values of some indices (from the OECD database) that measure the level of internal competition toughness for the both the "old" and the "new" members of the European Union, along with the candidate members. In particular, I looked for any empirical relationship between migration flows and gaps in country relative market competitiveness: this was to prove that the theoretical problems raised by my model can be realistic and plausible. Thus, I first wanted to evaluate the effectiveness of the current Union and then to figure out what would happen in case of a further increase of the EU size. So, data about migration flows revealed that after the enlargement in 2004, most of the movements of migrants departed from Poland and Czech Republic and were directed to the UK and Ireland, along with Germany within the continental area of the Union. Turning to the values of the selected OECD indices, the latter are of two types: indicators of product market regulation (i.e. entrepreneurship barriers, trade and investment barriers and state control barriers) and indicators of sectoral regulation (i.e. all professions barriers, retail trade barriers and energy, transport and communications barriers). About the first type, in summary, I found that, among the old EU countries, the largest barriers are in Greece, that has got the largest values for all the three indeces. Instead, the lowest barriers are in the UK and in Ireland. Thus, on the one hand, the new member states seem to have, on average, larger barriers than the original members; in particular, the countries with the largest barriers are Poland and Czech Republic. On the other hand, among the candidate

members, Turkey's indeces values always exceed old members average values and can be generally placed in within the top values of both the old and the new members. Moreover, Iceland has got very low barriers; particularly, they resulted to be always lower than the old members' lowest ones. In terms of indicators of sectoral regulation, it turned out to be slightly harder than in the previous case to make conclusions about entry barriers. For both the professional sector and the energy, transport and communications sector, the new EU members show higher barriers than the old members. Particularly, among the new members, countries with the highest barriers are Poland and Slovenia. Nevertheless, in terms of the retail distribution sector, the old members result to have larger barriers than the new members. Furthermore, among the candidate members, Turkey is far above the average indeces values in the two current EU members groups with respect to entry barriers to professions and the energy, transport and communications sector. However, in terms of barriers to the retail distribution sector, Turkey seems to have a less tough regulation of entry. Iceland, instead, has got lower barriers to the professions sector with respect to the index average values for the current EU members. In addition, it is above the average of the new member countries with respect to the retail distribution sector and above the average of the old member countries with respect to the energy, transport and communications sector.

In terms of the literature I can refer to, my framework is analytically consistent with Epifani and Gancia (2011) (EG 2011, hereafter). The latter is a static model featuring a continuum of industries. Those industries, that are heterogeneous by productivity, are aggregated according to a standard CES function. Within each industry there are possibly differentiated varieties; in this case, the perceived elasticities depends on the number of firms at the industry level (that can be heterogeneous across industries) and/or the elasticity substitution in consumption across varieties. Firms are owned by the totality of consumers, so that any profits are rebated. Indeed, there are some relevant differences between that framework and mine. First, the number of firms within each sector is low[19] and each firm's decision affects the others, so that markups turn out to be endogenous; furthermore, the monopoly power at the industry level is a weighted average of elasticity of substitution between varieties and industries. Thus, the number of competitors results to affect prices and quantities at the firm level. In my model, instead, the number of differentiated competitors in each industry is assumed to be very large, so that markups are exogenous; in addition, they only depend on the within industry demand elasticity. Second, in EG 2011, firms competing in the same industrial sector are homogeneous in terms of productivity: consequently, they all charge the same price, produce the same quantity and, finally, share the same amount of the production factor. In my framework,

[19] The number of firms is exogeneous in the restricted entry version of the model; instead, it is endogeneous in the free entry version of the model.

I allow firms to be heterogeneous by productivity, so that they will charge different prices, produce different quantities and they will not share the same amount of input factors. Third, they capture the preference for variety by a proper parameter, that can also be heterogeneous across industries. Turning to my setting, that parameter is assumed to be always equal to one, so that the model results to be neutral with respect to preference for variety. Fourth, another crucial difference between the two settings is in the industry entry mechanism. Epifani and Gancia distinguish between two separate frameworks. In the first one, there is restricted entry and sunk fixed costs are assumed to be zero, so that firms can make positive profits; in the second one, there is free entry and sunk fixed costs are larger than zero, so that competitors will keep entering the industry until profits are turned to zero. My setting relies on the restricted entry assumption: the (heterogeneous) number of firms within each industry is given; sunk fixed costs are assumed to be zero and firms' profits can be positive. Finally, assumptions on production factors also differ. First of all, production in the reference model relies on one input factor (i.e. labour), while my model on two production factors (i.e. labour and capital). Secondly, in the first setting, labour is inelastically supplied at the aggregate level and then distributed across all producers; in my setting, instead, capital is always assumed to be inelastically supplied at the aggregate level; labour is assumed to be inelastically supplied at the aggregate economy level in the first setting, but segmented at the industry (country) level in the second one. However, both EG 2011 with restricted entry and the model that I presented both lead to the same results in terms of labour allocation across industries and welfare.

So, with respect to important recent works about misallocation problems due to markup heterogeneity, such as Bilbiie, Ghironi and Melitz (2008) (BGM 2008, hereafter) and EG 2011 itself, it might be worth stressing that I consider a production function that has got two input factors (i.e. labour and capital) rather than only one (i.e. labour). This leads to possibly more complicated cases of distortion since the two inputs must interact in the production process and, at the same time, the respective markets they come from can crucially differ in terms of degree of mobility allowed. Furthermore, I suggest a different solution to market inefficiency, that does not imply lump-sum transfers as in BGM 2008 nor subsidies to production as in EG 2011. My solution might be thought of as more feasible, especially in an international context, where fiscal policy instruments are generally hard to be implemented because of difficulties in coordinating them across national borders. On the one hand, from a theoretical point of view, restrictions to factor mobility as a policy tool find support in Ottaviano and Thisse (2002), among others. On the other hand, from a more empirical point of view, support comes from what stated by the European Commission in 1999: "it could be an advantage of the new members [of the EU] to restrict this right [i.e. labour mobility across borders] for a set period of time. The economies of applicant countries are more likely to suffer a brain drain and loss of valuable

part of [their] workforce if early, unrestricted liberalization of labour markets is granted." Finally, Hindrinks (2001) indicated some practical ways to restrict labour mobility, such as zoning requirements, immigration policies and housing markets.

Indeed, the work is expected to be further extended in the future through both a theoretical development of the model and, possibly, an empirical validation of my economic predictions based on actual data. Thus, on the one hand, my framework might be developed by making markups endogenous through a free entry mechanism: within this scope, I would introduce sunk fixed costs in order to make the number of competitors within each industry not given. Keeping firms heterogeneous in terms of technical productivity, one of the scopes of this extension would be to model the relationship between the market specific competition toughness and the productivity distribution across competitors in that market. More specifically, the individual market specific markup would not just depend on the number of competitors as in EG 2011 and many other models featuring endogenous markups but rather on the number of firms that are productive enough to cover fixed costs and make nonzero profits if they choose to compete in the market. Therefore, it would be possible to establish a link not only between markup and aggregate productivity but also between markup and productivity distribution. In fact, there might exist markets with a very large aggregate productivity but with only a few very strong competitors that are able to enter the markets, so that those market would result really productive despite of a low internal competition. Furthermore, considering a dynamic perspective instead, I might consider firm level productivities coming from the same distribution across all the industries; moreover, I might also assume that the starting number of firms in each industry is the same. Thus, the shock affecting only one firm in only one industry could then change the number of firms within that industry and, if the markup depends on the number of firms, that shock involving only one firm could lead to markup heterogeneity and then to misallocation of input factors. Therefore, this extension would give a more precise picture of competition, particularly at the international level, as it would represent and link with each other very important features of market structure, such as competition toughness and productivity distribution of producers.

On the other hand, I am also going to try to find empirical evidence of what my model predicts. In particular, the plan is to measure average price-cost margins and aggregate productivities for the member countries that have joined the European Union so far and, then, to estimate an efficient allocation of both labour force and investments in each of the member country according to those measures and my model's predictions. Thus, I would be able to compare the results from those estimates with actual allocation of labour and capital across the Union in order to possibly verify the power of my theoretical predictions. Finally, within this scope, I could exploit the large database provided by Amadeus (Bureau van Dijk), that collects data at the company level on standardized annual accounts,

financial ratios, sectoral activities and ownership for 38 European countries, so that it seems to be very useful for this research project.

4 Pricing-to-Market and Trade Costs Meet Country-Specific Tastes: Closing the Gap on the PPP Anomaly

4.1 Introduction

The fourth chapter of my thesis aims at addressing an issue that Obstfled and Rogoff (2000) (OR 2000, hereafter) defined as one the six major puzzles in international economics: the purchasing power parity puzzle. Thus, the first goal is to study the impact of cross-country preference asymmetry on differences in international prices. A lot of evidence has been reported about how the same goods can be priced differently according to the (national) markets in which they are sold. One of the resons might be linked to the fact that consumers from different areas in the world have different tastes that can affect international trade in terms of both quantities and prices. Different tastes can be due to several factors, of cultural or environmental type. For example, selling Italian coffee in India can be not as easy as in Italy simply because Italian consumers like Italian coffee more than Indian consumers do; selling Chinese noodles in Italy can be a hard business as consumers normally prefer Italian pasta over there. Furthermore, the geographical environment can also matter. In particular, climatic characteristics of markets could affect expenditure preferences. For instance, selling umbrellas in desertic areas might be something really difficult to do with respect to, say, Scotland, such as selling air conditioners in North Africa countries can be much easier than selling them in Arctic areas.

Therefore, even in a more and more integrated international market, the country level total expenditure of households can be distributed in a very different manner over the same items. This could make selling a particular good abroad easier or harder than at home, according to the tastes of the destination countries. Moreover, preference asymmetry across different national markets might also affect international prices. In fact, tastes could contribute to determine the size of the market of a particular good; in turn, this could affect the degree of competition between the producers of that good and, consequently, the market power and pricing strategies of each of them. More specifically, the smaller the size of the market for a good, *ceteris paribus*, the lower the expected competition in the production of that good, the larger the market power held by competitors and, then prices charged.

Furthermore, the effect of preference heterogeneity on international trade may become even more plausible in the form of home bias by taking also into account economies of scale. More specifically, the latter imply that national economies tend to produce more those goods that domestic consumers like more than others. This is to exploit increasing returns to scale, that is cost advantages implied by larger sizes of businesses, due to fixed

costs of production. Thus, producers might have to charge different prices in different countries not only because they have to deal with trade costs when they sell abroad, but also because country specific preferences might crucially affect the degree of competition and then the pricing for competitors.

As explained in OR 2000, the Purchasing Power Parity consists in a weak connection between exchange rates and national price levels. In more detail, according to the Purchasing Power Parity theory (or *absolute* PPP), the real exchange rate between two countries is equal to one or, alternatively, tends to turn back to the unity when the long-run ratio changes for some reasons:

$$\sum P_i = E \sum P_i^*,$$

where P_i is the domestic-currency price of good i, P_i^* is the foreign-curreny price, and E is the exchange rate, defined as the home-currency price. On the other hand, according to a weaker version of the same theory (or *relative* PPP), changes in national price levels are always equal to one or have the tendency to equalize in the long-run:

$$\frac{\sum P_{i,t}}{\sum P_{i,t-1}} = E \frac{\sum P_{i,t}^*}{\sum P_{i,t-1}^*}.$$

Finally, an even stronger version of the absolute PPP is the *Law of One Price* (LOP), stating that if trade barriers (either natural or government imposed) are absent, any commodity would be sold for the same price everywhere:

$$P_i = E P_i^*.$$

In this chapter (such as in the next one), I want to study the determinants of short-term deviations from the relative PPP and, particularly, on pricing-to-market. I can refer to many important modern works on this subject. Following, I will try to give a short review. P. Krugman (1986) observed that movements of US import prices are not perfectly correlated with movements of exchange rates: this made some evidence of pricing-to-market by foreign sellers to the American market. From the theoretical point of view, Krugman mostly explained pricing-to-market through dynamic models of imperfect competition. He particularly focused on both the role of supply dynamics (coming from the adjustment costs of distribution infrastructure related to imports) and the role of demand dynamics (coming from the firm's investments in reputation). Feenstra, Gagnon and Knetter (1996) tried to explain why import prices do not fully respond to exchange rates (i.e. incomplete pass-through). Exploiting a panel data set on automobile exports from the US , Germany, France and Sweden to twelve destination countries, they found that pass-through is increasing in the export country's market share in a particular import

market. The intuition was that, for a given demand, if the market share is very high, then the exporter will deal with a poor competition and, consequently, will be more keen to pass through an exchange rate. Backus and Cucini (2000) studied the variability of terms of trade with respect to real output and trade volumes. They set up a dynamic equilibrium model of international business cycle. They found that comovements of terms of trade mostly depend on the source of shocks. Namely, movements of terms of trade and output turned out to be positively correlated if they were both generated by productivity shocks. Instead, such correlation resulted to be negative if those movements were generated by oil supply shocks. This is because in case of, for example, a negative shock on oil prices, domestic output of industrialized countries falls with respect to domestic output of nonindustrialized producers of oil, while relative prices of industrialized countries' domestic goods increase. According to Goldberg and Verboven (2001) there are three potential sources of price differences across countries: price elasticities leading to differences in markups, costs and import quotas constraints. They employed a large dataset comprising information on 150 car models across five national markets (Belgium, France, Germany, Italy and the UK) to make some empirical estimates. In particular, they found that French, British and, especially, Italian consumers regard goods from the same country origin as closer substitute with respect to goods coming from different countries. In Germany, instead, domestic and foreign goods belonging to the same market segment resulted to be equally substitute. Crucini, Telmer and Zachariadis (2005) developed an empirical study in the Law of One Price (LOP) theory, according to which identical goods should be priced the same in different countries, once their prices are turned into a common currency. So, they measured good-by-good deviations from the LOP for a large range of goods and services across all European countries. They mainly showed, exploiting classic characteristics of goods, that good-by-good dispersion in the absolute LOP deviations depend negatively on the tradeability of goods and positively on the share of non-traded inputs used for the production of goods. Berka and Crucini (2009) developed a study about the sources of terms of trade over a panel of 38 countries, aiming at detecting the contributions of individual goods to the variance of the aggregate terms of trade. Particularly, this work built up an alternative measure of the standard terms of trade, that is the consumption terms of trade. Their data allowed to distinguish between retail prices of traded goods that are faced by national consumers and relative prices of the same goods that are calculated according to trade prices at the border. If producers and consumers cope with the same prices, then there is no difference consumption and production terms of trade. One of the most important finding was that consumption terms of trade at local price is more volatile than then production terms of trade at world prices, even though they are correlated to each other. Berka and Devereux (2010) measured real exchange rates at both disaggregate and aggregate level and found that the PPP did not hold for

any European country. Particularly, deviations from PPP turned out to be larger for non-tradable goods than for tradable ones. Furthermore, they showed that real exchange rate in significantly determined by relative GDP per capita across different countries.

Another important strand of the PPP literature, instead, has focused on one further issue related to the puzzle, that is the slow rate at which deviations from PPP die out (however, I do not deal with this particular issue within my research work.) Rogoff (1996) considered several different sources of international divergence of prices, such as transportation costs, tariffs, nontariff barriers, information costs and different national quality standards. He mainly explained the PPP puzzle with the fact that international goods markets are not as integrated as the domestic ones due to high trade barriers for many goods. Obstfeld and Rogoff (2000) addressed the persistence of real exchange rates deviations. First, in terms of mean reversion of shocks, they did not find too much difference between prices of tradables and nontradables. This was because, as they argued, many traded goods already include many nontradable components. Moreover, they claimed that monopolistic supply of goods can explain international price differentials only for "big ticket" commodities, such as cars, but not for smaller ones, such as clothes. Thus, they turned to trade costs as a more plausible rationale. Cheung, Chinn and Fujii (2001) analysed the connection between market structure and the persistence of sectoral real exchange rates for a panel of 14 OECD countries. The main result was that the more imperfect the industry market competition, the larger the tendency to pricing-to-market and, then, the slower the rate of PPP reversion. Imbs, Mumtaz and Rey (2005) claimed that there is no reason why every good should converge to international price parity homogeneously at the same time: so, the relative price dynamics varies across goods, that can crucially differ according to, for instance, degree of tradability, degree of competition, or transportation costs. Therefore, the too slow mean reversion of aggregate exchange rate was due to the fact that such a heterogeneity in price adjustment dynamics at the individual good level was not taken into account. Crucini and Shintani (2008), using US sectoral data, found a positive correlation between the persistence in LOP deviations and distribution margins: more specifically, those margins included costs needed to move goods and services from the producer to the consumer.

My contribution to the literature shortly summarized above consists in extending the model set up by Atkeson and Burstein (*American Economic Review*, 2008; AB (2008), hereafter) by introducing cross-country heterogeneity in demand preferences and home bias effect. The original framework is a model aiming at explaining large and systematic deviations from the relative PPP (Purchasing Power Parity, i.e. the hypothesis according to which the relative price of a trade good should stay constant over time.) So, the main object was to theoretically address two empirical facts: first, the terms of trade of

manufacturing goods, defined as a country' s ratio of export and import prices relative to its partners of trade, are much less volatile than the Producer Price Index-based real exchange rate for the same type of goods; second, movements in Consumer Price Index-based real exchange rates for manufacturing goods are almost as volatile as movements in Producer Price Index-based real exchange rates for manufactures. The common explanation that the authors gave to both the issues was related to pricing-to-market, that is the choice of individual producers to change the relative price of her output abroad and at home as a response to aggregate international shocks. More specifically, their model relies on two main characteristics: imperfect competition with variable markups and international trade costs (both fixed and "iceberg" type marginal costs.) Thus, firms did not result to completely pass through variations in marginal costs to prices due to the fact that markups depended on the market share. However, imperfect competition with variable markups is a necessary but not sufficient condition in order to have pricing-to-market: in fact, without any trade costs, firms have to face the same competitors both abroad and at home, so that they will have the same markups and charge and the same prices in both the markets. So, their model turned out to be able to match many relevant characteristics of international trade and market structure and, particularly, to reproduce actual deviations from the relative purchasing power parity in the US. With respect to the framework quickly summarized above, I first introduce asymmetry in demand preferences: this is obtained by giving the same panel of commodities aggregated in the final consumption good heterogeneous weights across the two countries that the model features. Furthermore, the home bias effect is captured by adding not only heterogeneity in preferences, but also fixed costs of production. So doing, sectors related to larger preference weights will comprise a larger number of competitors as long as larger weights will scale up revenues and profits that, in turn, will be more likely to cover the entry costs.

Nevertheless, I think that their work leaves something that can be further improved, especially in terms of the second "fact". Their simulations showed that reaction to aggregate shocks of CPI-based RER is equal to only a bit more than 80 percent of the reaction to aggregate shocks of PPI-based RER: thus, there is a remaining 20 percent of the actual relationship between the two movements that still needs to be explained. So, this is the challenge of the second part of my thesis. In more detail, the link between PPI-based real exchange rate and the terms of trade is explained by the following formula:

$$\widehat{\frac{PPI}{PPI^*}} = \widehat{\frac{EPI}{IPI}} + \widehat{\frac{PPI}{EPI}} + \widehat{\frac{IPI}{PPI^*}}, \tag{36}$$

where PPI/PPI^* is the PPI-based real exchange rate, EPI/IPI is the terms of trade, PPI/EPI is the ratio of domestic producer and export prices and, finally, IPI/PPI^* is the ratio of import (that is, foreign country export) and foreign producer prices. Notice that hats indicate changes in the logarithm of the variables; furthermore, nominal exchange

rates are not used in order to express international price ratios as prices are assumed to be measured in a common currency. In case of relative PPP holding, the last two terms of (36) are zero; however, AB 2008 provided evidence that they are actually larger than zero at the aggregate level and that was the first signal that, in fact, PPP did not hold. On the other side, one further signal of not holding relative PPP was that international trade was not able to reduce the impact of movements in relative producer prices on relative consumer prices for tradable goods. In terms of formula, I can express the relationships between consumer price and producer price in both the domestic country (say country 1) and the foreign country (say country 2) as follows:

$$\begin{aligned}\widehat{CPI}_1 &\simeq \widehat{PPI}_1 + s_1\left(\widehat{IPI}_1 - \widehat{EPI}_1\right),\\ \widehat{CPI}_2 &\simeq \widehat{PPI}_2 + s_2\left(\widehat{EPI}_1 - \widehat{IPI}_1\right).\end{aligned}$$

More specifically, s_1 and s_2 are the share of consumption expenditure on imports in, respectively, country 1 and country 2. In particular, due to preference asymmetry across countries, it can be

$$s_1 \neq s_2,$$

so that shares of consumption expenditure on imports, that are assumed to be equal in the original framework, are allowed to differ in my model. Nevertheless, such an asymmetry does not necessarily imply trade unbalance between the two countries as long as countries can be asymmetric in size.

Thus, the ratio of the change in the CPI-based RER (real exchange rate) and the change in the PPI-based RER is given by

$$\frac{\widehat{CPI}_1 - \widehat{CPI}_2}{\widehat{PPI}_1 - \widehat{PPI}_2} = 1 - (s_1 + s_2)\,\frac{\widehat{EPI}_1 - \widehat{IPI}_1}{\widehat{PPI}_1 - \widehat{PPI}_2}. \tag{37}$$

Of course, as in AB 2008, the latter expression highlights that the larger deviations from the relative PPP, the more relative consumer prices and relative producer prices move together. If PPP holds, then the second term of the right side of (37) is very close to 1 (both at in the domestic market and in the foreign market, prices react to shocks in the same way), so that fluctuations in relative consumer prices as a share of fluctuations in relative producer prices almost amount to 0[20]

[20]In more detail, the closer (37) to the unity, the closer $\left(\widehat{EPI}_1 - \widehat{IPI}_1\right) / \left(\widehat{PPI}_1 - \widehat{PPI}_2\right)$ to zero, as long as there are some imports in both country 1 and country 2 (i.e. s_1 and s_2 are positive). So, showing that (37) is almost 1 implicitly leads to show also that the terms of trade is significantly less volative than PPI-based real exchange rate, that is the first "fact" regarding the U.S. economy that Atkeson and Burstein wanted to explain through their model.

4.1.1 *Heterogeneity in demand preferences: evidence*

The first idea to try to improve AB (2008) is to introduce cross-country asymmetry in demand preferences. The intuition starts from observing that even in a globalized market, there are still crucial differences in demand preferences across countries. Those differences are often hard to relax because of cultural, geographical, climatic, etc. reasons and might crucially affect the market share that an international trader can gain by selling in a foreign country. Thus, such a heterogeneity might help explaining quantities and prices of goods/services traded internationally.

In the literature, it is possible to find some studies about the connection between "identity" and economic outputs. For example, Akerlof and Kranton (2000) included identity within a model of behaviour; more specifically, they analyzed different examples of bahaviours that are related to identity, such as gender discrimination in the labour market, the household division of labour and the economic mechanics of social exclusion and poverty. The first result was that people take identity-based payoffs from their own actions. The second result revealed that people take identity-based payoffs also from others' actions (externality effect). Finally, third parties can produce persistent changes in people's payoffs. Francois and Ypersele (2002) defined cultural goods as those goods that domestic consumers value in a different manner with respect to foreigners and that are produced by increasing returns to scale technologies. A real case reported in this work was that of Hollywood movies that, according to the popular press, were threatening traditional cultures within European countries. Giannetti and Yafeh (2008) focused on the effects of cultural differences across financial markets. Through a large dataset of international syndicated bank loans, they first found that professional decision-makers are keen to give better contractual conditions and share risk with counterparts that result to be more alike. On the other hand, participant banks turned out to fund syndicated loans from culturally distant banks for lower portions. Olivier, Thoenig and Verdier (2008) developed a model aimed at examining the relationship between international trade and the dynamics of cultural identity. So, in their model, they included a cultural good, that was meant as a positive group externality among individuals having the same culture and the same consumption patterns of that good. There were assumed two types of agents: *homo economicus*, who does not benefit from the group externality and *homo culturalis*, who benefits from both individual consumption and positive group externality. In terms of results, on the one hand, cultural identity affected both prices and allocation of resources through the standard demand channel: the larger the size of a given cultural community, the larger the demand for the relative cultural good, the larger the price of that good in equilibrium. On the other hand, there is also a cultural identity effect leading to cultural homogenization over the society. Auer (2008) focused on a two-sided heterogeneity: on the

one hand, products are heterogeneous in their attributes; on the other hand, consumers are heterogeneous in their taste for those attributes of products. The work found that taste differences across countries are a limit to international trade; however, in the long-run, volume of trade turned out to be the same as in the case of no taste differences across countries. The latter means that Linder (1961)'s theory according to which taste heterogeneity is an impediment to international trade holds only in the short-run.

In order to empirically illustrate how demand preferences differ across countries, I employ OECD data on national CPI weights.[21]Specifically, the weight of each good in a CPI represents the share of total household expenditure that is spent on that good over the weight reference period. So, I choose to take the values of CPI weights in year 2000 for the US and for the US' major international trading partners. In the following Table 4.1, I report the ranks of the top 10 US international merchandise trading partners by value in 1980, 1990 and 2001, compiled by the Bureau of Transportation Statistics of the US Department of Transportation. In 2001, the trade with the top 10 partners represented more than 68 percent of the total international trade volume of the US. Notice that the first three positions have been held by Canada, Japan and Mexico, while Germany and the U.K have been stably holding, respectively, the fourth and the fifth position. South Korea and China have become more and more important as US trading partners by time. In particular, China jumped from the 24th position in 1980 to the 4th position in 2001. Finally, Italy and France held the bottom positions among the top 10 US partners in 2001, changing not so much since the last two decades.

[21]These are annual expenditure weights for the national CPI at the level of COICOP classification.

Table 4.1.

Top 10 US International Trade Partners by Value:1980-2000

Country	Rank in 1980	Rank 1990	Rank in 2001	Total Trade, 2001
Canada	1	1	1	380,693
Mexico	3	3	2	232,942
Japan	2	2	3	184,241
China	24	10	4	121,515
Germany [22]	4	4	5	89,265
United Kingdom	5	5	6	82,195
South Korea	13	7	7	57,381
Taiwan	9	6	8	51,543
France	7	8	9	50,191
Italy	11	9	10	33,740
Top 10				1,283,707
Top 10, % of total				68.53%
Total, all countries				1,872,985

Source: OECD database

So, from the OECD dataset, I pick up the CPI weights for the following US international trading partners: Canada, Mexico, Japan, Germany and the UK. These countries, along with China (that I exclude here as it does not belong to OECD which, in turn, does not provide data on CPI weights), represent a big share of the total international trade of the US and then they might well show in practice the extent to which the US have to deal with international preferences heterogeneity. The OECD dataset provides data on CPI weights related to 58 products classified according to the four-digit C.O.I.C.O.P. (Classification of Individual Consumption According to Purpose) nomenclature. Then, I group all the products according to seven broad categories: Food, Housing, Apparel, Transport and Communication, Medical Care, Education and Recreation, Other Goods.[23] In Table 4.2 below, I report the aggregate CPI weight associated to each of those categories for the US and the US trading partners.

From the CPI weights presented, with respect to all the international trading partners in the table, the US turn out to have a relatively larger share of total household expenditure spent for Housing (including housing, water, electricity, gas and other fuels, furnishings, household equipment and routine household maintenance, restaurants and hotels) and Medical Care and a lower share spent in Food (including food, non-alcoholic and alcoholic beverages and tobacco), Apparel (including clothing and footwear) and Education and Recreation (in the latter, it precedes only Mexico). Furthermore, turning to the US trading partners, Mexico and, in a second position, Japan result to be among the farthest

[22] For 1980 and 1990, Germany includes both West Germany and East Germany.

[23] See the Appendix for the the contents of each of those categories.

ones from the US in terms of expenditure shares on Food and Housing, that represent more than half of the total expenditure for all the countries apart from the UK (for which they represent slightly less the 50 percent of the total). The UK are very far in terms Housing (45.28 percent in the US versus 33.4 percent in the U.K), Medical Care (5.51 percent in the US versus 2.5 percent in the UK) and Education and Recreation (9.12 percent in the US versus 17.1 percent in the UK). The UK is also the most distant trade partner in terms of expenditure share in Apparel (4.39 percent in the US versus 6.7 percent in the UK). Overall, the most homogenous country with the US in terms of total household expenditure shares seems to be Canada; among the European countries, instead, Germany seems to be relatively closer with respect to the UK. Indeed, at the more disaggregate level, such a heterogeneity in CPI weights becomes even more evident.

It is also worth noting that the cross-category heterogeneity in preferences also vary across countries. In fact, as shown by the standard deviation values at the bottom of Table 4.2, there are countries, such as the US ($s.d. = 14.38$) and Canada ($s.d. = 13.28$), where preferences seem to be more concentrated in some categories (namely, Housing and Transport and Communication) with respect to the others. On the other side, the UK turn out to have the lowest standard deviation (equal to 10.39) across category relative preferences, that are then more evenly distributed across expenditure items.

Table 4.2. CPI weights % (year 2000)

	Countries					
Sectors	US	Canada	Mexico	Japan	Germany	UK
Food	11.48	16.06	29.2	21.6	14.01	16.2
Housing	45.28	40.1	31.17	37.5	41.78	33.4
Apparel	4.39	6.58	6.6	5.7	5.51	6.7
Transport and Communication	17.64	21.17	17.38	11.5	16.39	17.7
Medical Care	5.51	2.2	3.42	3.8	3.54	2.5
Education and Recreation	9.11	10.67	8.2	14.1	11.75	17.1
Other goods	6.59	3.22	4.03	5.8	7.02	6.4
Total, %	100	100	100	100	100	100
s.d. across categories	14.38	13.28	11.80	11.94	12.98	10.39

Source: OECD database

4.1.2 *Fixed costs of production and home bias effect: evidence*

A more complicated extension of AB (2008) that I employ consists in introducing fixed costs of production and home bias effect. Particularly, the latter implies that, in presence of increasing returns, countries will be more oriented to produce and export those goods for which they have relatively larger markets.

One of the most important works about the home bias effect is Krugman (1980). The

latter is two-country monopolistic competition model with free entry (i.e. monopoly profits are driven to zero). The main result was that the larger the trade costs, the larger the taste specialization, the larger the scale economies and the larger the specialization in the production of one particular good: in turn, this specialization increases the opportunity to become a net-exporter of that good. Thus, a key role in determining the home bias effect is taken by fixed costs of production and economies of scale. Blanchard and Kiyotaki (1987), through a famous monopolistic competition model, studied the effects of aggregate demand, depending on real money balances, on output. In particular, they found that, if there are fixed costs, the movements in output, productivity and profitability result to be positively correlated. The latter result led to implications in terms of entry. In more detail, if fixed costs reduce aggregate demand, then the profits earned by firms can be negative; moreover, imperfect competition prevents new entrants from catching all the demand by lowering prices with respect to existing firms. Therefore, very high nominal wages can stop new firms from entering the market. Rotemberg and Woodford (1993) analyzed the importance of taking into account imperfect competition in order to accurately measure the effects of various shocks to the economy. In terms of economies of scale, they found that zero profits are compatible with a wedge between marginal costs and factor prices if the average returns to scale are equal to that wedge: thus, in case of increasing returns, average cost is larger than marginal cost and price can equal average costs (and profits can be zero) even if price is larger than marginal cost. Kim (2004) developed a theoretical dynamic setting that comprises four relevant characteristics of models with scale economies: fixed costs, variety of products, decreasing marginal costs and market power. The work led to two main conclusions. First, if fixed costs do not vary and profits are driven to zero in every period, then the aggregate increasing returns to scale only depends on the degree of returns to variety. This is due to endogeneity of the number of firms, that is determined by a mechanism of entry and exit: movements in the number of firms can be regarded as movements in productivity in reaction to aggregate shock to inputs. Second, if fixed costs are allowed to react to changes in aggregate productivity or the zero-profit condition does not hold in the short-run, then aggregate returns to scale turn out to be determined by product variety, diminishing marginal costs and market power.

Turning the specific home bias effect, Roy and Viaene (1998) set up a Ricardian model featuring country bias in consumer preferences. More specifically, identical physical goods can be perceived as different by consumers as they are manufactured in different countries. Such a perception might be due to different factors, like the reputation of quality of goods produced in some particular countries, information and beliefs on the production process in other countries, considerations of noneconomic nature related to social or political bias. So, the first contribution of this work is that production specialization across countries can be affected by the preference, leading to equilibria that differ from

those predicted by the classical Ricardian model. The second major result of this paper is that both inter-industry and intra-industry forms of trade can happen at the same time despite of the absence of market imperfection, strategic behaviour or product differentiation. Hillberry and Hummels (2002) focused on the relationship between home bias effect and the co-location decisions of both intermediate and final goods producers. Thus, small trade costs imply co-location between producers of intermediate goods and producers of final goods: industrial demands turned out to be more oriented towards goods that are locally available because firms move in order to minimize trade costs. Therefore, demand resulted to be home biased in general equilibrium. Hanson and Xiang (2004) built up and empirically estimated a model aiming at studying the variation of home market effects across different industries. From the theoretical point of view, the main implication of their model, featuring two countries, one large and one small, was that the home market effect depends on the number of industries with differentiated products within the whole economy. On the one hand, in case of many industries, those industries with larger transport costs and lower substitution elasticity will tend to concentrate more within the large country with respect to those industries with lower transport costs and larger substitution elasticity. On the other hand, in an economy with only two industries, those industries with high transport costs and low demand elasticity will tend to concentrate in the large country in absolute and not just in relative terms. Lopez, Pagoulatos and Gonzalez (2006) measured the degree of home bias for processed food and beverage products within the US. So, their work provided evidence of strong "home bias" that significantly prevented foreign imports from entering the US domestic market; furthermore, they showed that imports levels, on average, would be nine times as large as the actual ones if the home bias did not exist. Therefore, the main conclusion is that the home bias effect is not only determined by the supply side (such as had been already showed through gravity models) but also by demand preferences. Whalley and Xin (2007) set up a numerical general equilibrium model in order to measure the effects of changes in home bias within regions on the worldwide trade growth over the last decades. They discovered that changes in home product differences over the period considered (i.e.1975-2004) could have led to a reduction in global trade by 27 percent with respect to 2004 levels. More specifically, larger effects came from home bias changes in developing countries with respect to effects from developed countries. These results seemed to be indicating the growing importance of regionalization within the global economy, probably due to an increase in the number of trade agreements. Mylonidis (2008) studied the relationship between home bias towards domestic tradable goods and deviations from PPP. The work first provided a two-country model, where consumers are assumed to buy two types of goods: a domestically produced good and a foreign produced good. Then, in the empirical part, the "home" country was represented by a pool of countries (Germany, Japan, France, Italy, Canada and the UK),

while the "foreign" country by the US; the main result was that the home bias was able to explain a large part of the PPP deviations. Finally, Balta and Delgado (2009) claimed that the policies aimed at building up a Single Market in Europe were not so effective because, as they showed, all EU 15 countries are more oriented to consume home products and invest in home equities. Furthermore, with respect to their economic size, EU 15 countries resulted to be more home biased than Japan and the US. In more details, there are some countries, such as the Netherlands, Belgium, Austria and Germany, that seemed to be integrated, while there are other countries, such as Greece and Spain, whose demand resulted much less oriented to foreign products and equities.

In order to give some empirical evidence of the presence of home bias in the US and in some of its major trading partners, I graphically show the relationship between consumption and production at the sector level. So, I exploit the OECD Stan database. In particular, I collect data on consumption (HHFC, that is Household Final Consumption) and on production (Gross Output at basic prices) from the Input-Output tables. The number of enterprises, instead, is taken from SSIS (Structural Statistics of Industry and Services). All the data are referred to two-digit industry level (ISIC, International Standard Industrial Classification, Revision 3)[24]

Figure 4.1 below shows that, in the US in middle 2000s, consumption and production patterns across different industries are fairly similar: the larger the consumption of the product of a given industry, the larger the production of that industry. In particular, the number of enterprises in a given industry seems also to be positively correlated to the total production/consumption of that industry's good. Thus, the larger the share of total household expenditure on the product of given industry, the larger the production of that product and the larger the amount of firms that enter that industry. Indeed, at the domestic level, consumers' preferences result to be correlated to how much each industry produces and how many firms can (profitably, presumably) enter in each industry. So, in an internationally open market, I might also expect foreign competitors to be also limited by the domestic demand preferences of the destination market: the thinner the demand preference for a given product in country, say, 1, the lower the chances to earn profits by producing and selling that good from country, say, 2 to country 1.

Figure 4.2 below illustrates the same patterns of consumption, gross output and number of enterprises across industries for the UK, in the middle 2000s. In this case, the positive correlation between consumers' preferences and the number of active enterprises across industrial sectors seems to be even more evident[25].

[24] See the Appendix I for the list of industries considered in this empirical analysis.
[25] See the Appendix for other examples.

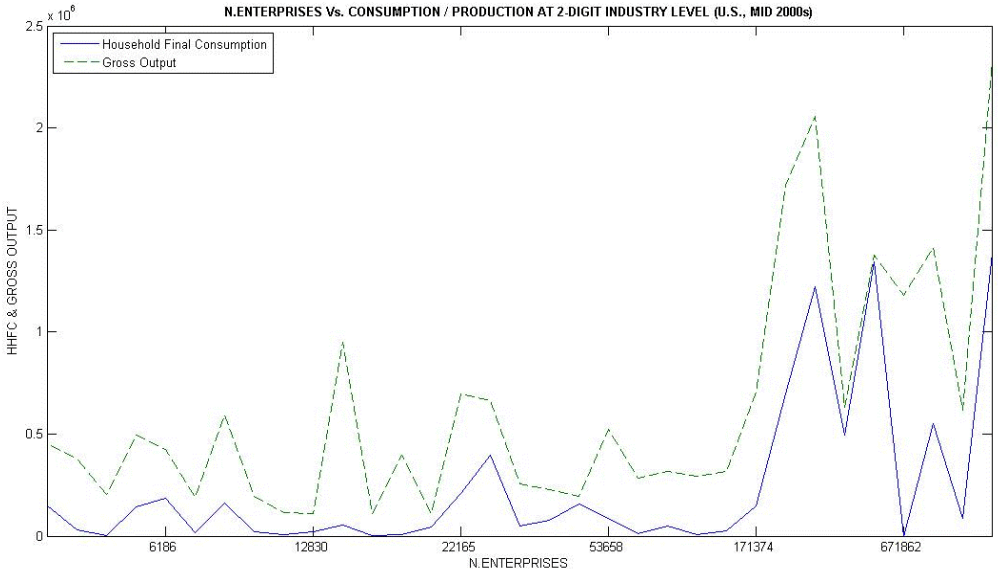


Figure 4.1. Home bias. US, mid 2000s

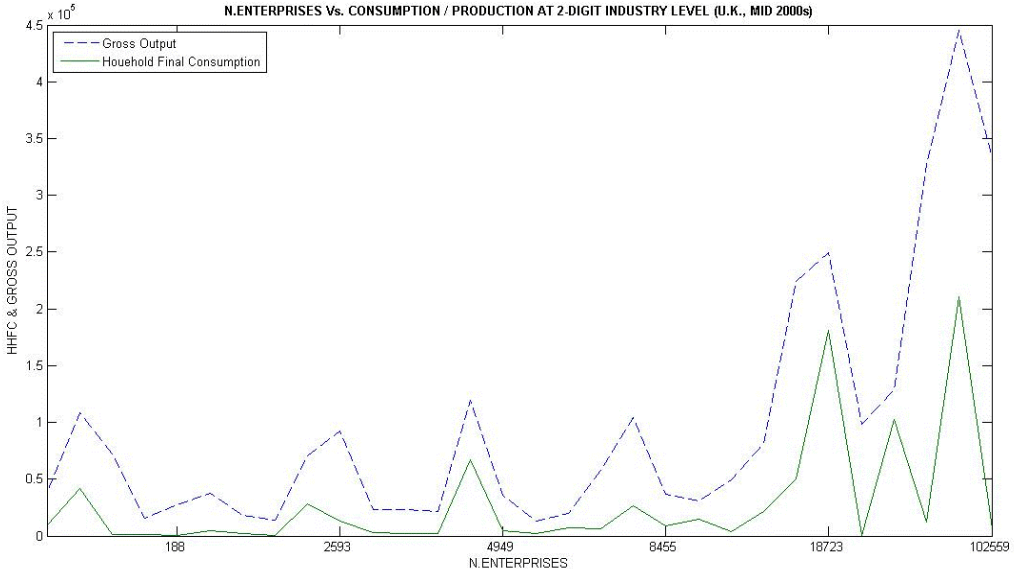


Figure 4.2. Home bias. UK, mid 2000s

4.2 The model

The model I set up is a direct extension of AB (2008) framework. The latter is a two-country model where each country (indexed by $i = 1, 2$) produces a large amount of differentiated goods. Trade between those two countries is limited by two types of trade costs: fixed costs and iceberg marginal costs. Furthermore, the driving force of interna-

tional price fluctuations is given by aggregate shocks to productivity.

Preferences in country i are assumed to have the following from:

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_{it}, 1 - l_{it}\right),$$

where β is the discount factor and $u\left(c_{it}, 1 - l_{it}\right) = \log\left[c^{\mu}\left(1 - l_{it}\right)^{1-\mu}\right]$. In particular, c_{it} indicates final consumption and l_{it} indicates the working hours of the representative household in country i at time t. In the maximization problem, the consumet budger constraint is:

$$P_{it}c_{it} + b_{it+1} = W_{it}l_{it} + (1 + r)b_{it},$$

where the expenditure side of the constraint is given by the sum of purchase of the final consumption good and purchase of one-period-forward bonds while the income side is given by the the sum of labour income and income from maturing bonds purchased at time $t-1$. Moreover, in each country households are assumed to trade a complete set of international assets. Households utility maximization problem yields the following standard first order conditions:

$$\frac{1 - \mu}{\mu}\frac{c_{it}}{1 - l_{it}} = \frac{W_{it}}{P_{it}} \quad for \quad i = 1, 2, \tag{38}$$

$$\frac{c_{2t}}{c_{1t}} = \frac{P_{1t}}{P_{2t}}, \tag{39}$$

where W_{it} and P_{it} indicate, respectively, the wage and the final consumption price in country i at time t. Thus, 38 and 39 are used in solving for equilibria and they hold for every t and for every state of nature. Finally, the intertemporal first-order condition for the dynamic choice problem is explained by the following Euler condition:

$$\beta\frac{P_{it}}{P_{it+1}}\left(1 + r\right)u_c'\left(c_{it+1}, 1 - l_{it+1}\right) = u_c'\left(c_{it}, 1 - l_{it}\right).$$

Aggregation of Goods into Sectors

As the model targets the study of the behaviour of international relative prices at both an aggregate and a disaggregate level, it features more levels of aggregation of goods. Individual firms produce goods, that are commodities representing physical objects, which can be traded across coutries. Moreover, firms sell their outputs to specific sectors. The latter are the first level of aggregation used in the model and represent the lowest level of disaggregation of commodities employed for the construction of price indeces. In more detail, in each of those sectors there are only a small number of firms: this means that the price charged by each firm is affected by the prices charged by all the other firms

within the same specific sector. Finally, sectors are aggregated into a final composite consumption good. Next, I describe the aggregation of differentiated goods into sectors and the aggregation of sectors into final consumption at time t (the subscript t will be dropped for simplicity.) So, final consumption, c_i, is obtained by aggregating the large number of sector level intermediate aggregates, y_{ij}, for $j \in [1, S]$ according to a standard CES function[26]

$$c_i = \sum_{j=1}^{S} \left[u_{ij} y_{ij}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \quad where \quad \sum_{j=1}^{J} u_{ij} = 1. \tag{40}$$

The aggregate price P_i for final consumption is equal to

$$P_i = \left[\sum_{j=1}^{J} u_{ij}^{\eta} p_{ij}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \tag{41}$$

and the inverse demand for the output of individual tradable sectors is given by

$$\frac{P_{ij}}{P_i} = \left(\frac{y_{ij}}{c_i} \right)^{-\frac{1}{\eta}} u_{ij}. \tag{42}$$

Here, the weight u_{ij} in (40) is used as to indicate the preference for the consumption of a particular set of goods associated to sector j in country i.[27]In particular, it represents the share of country i representative household final consumption on sector j specific goods. Therefore, such weights are used to proxy country level demand preferences, i.e. the shares of aggregate consumption (c_i) on each sector j, representing the lowest level of disaggregation of commodities used for national price index construction. So, turning to the lower level of aggregation, in each country i and sector j there may be, in equilibrium, up to K domestic firms selling differentiated goods and up to K foreign firms selling their output to the same sector. In terms of notation, firms $k = 1, 2, ..., K$ are indicated as domestic, while firms $k = K+1, K+2, ..., 2K$ as foreign. So, assuming that there are no international trade barriers and fixed production costs either, so that all the firms, both domestic and foreign, are able to sell in each sector, sector level aggregate consumption is given by

$$y_{ij} = \sum_{k=1}^{2K} \left(q_{ijk}^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}, \tag{43}$$

where q_{ijk} indicates the sales of firm k in sector j and country i. Goods within the same

[26]This way of aggregating goods is very similar to that used in Bhaskar (2002): individual goods are aggregated according to a nested CES function in order to yield the final composite consumption good.

[27]See Galì and Monacelli (2005): they similarly used weights in the final consumption function in order to proxy the preference of the domestic representative consumer for goods coming from different national markets.

sector are assumed to be more substitutable than goods across different sectors, that is $1 < \eta < \rho$. Note that imperfect substitution between goods within the same sector implies that each firm within that sector charges a distinct price although firms are involved in quantity competition. As standard, the aggregate price at the sector level is equal to

$$P_{ij} = \left[\sum_{k=1}^{2K} \left(P_{ijk} \right)^{1-\rho} \right]^{\frac{1}{1-\rho}}, \tag{44}$$

and the inverse demand for differentiated goods within a given sector is equal to

$$\frac{P_{ijk}}{P_{ij}} = \left(\frac{q_{ijk}}{y_{ij}} \right)^{-\frac{1}{\rho}}. \tag{45}$$

4.2.1 A simple case: heterogeneous demand preferences

Production

Firms produce according to a constant returns to scale function employing labour as the only input. In particular, the production function of a firm takes on the following form:

$$q_{ijk} = A_i z_{jk} l_{ijk}, \tag{46}$$

where l_{ijk} is the labour amount employed at the firm level, A_i is the aggregate productivity in country i, that is common to all firms producing in that country, and z_{jk} is the firm level productivity. Each firm within sector j and country i draws its idiosyncratic productivity z_{jk} from a log-normal distribution, that is $\log z_{jk} \sim N(0, \theta_j)$. More specifically, firm level productivity is assumed to be constant over time, while the aggregate productivity, A_i, is allowed to change after shocks to the aggregate national economy i .

On the one hand, a firm with productivity z_{jk} selling to the domestic market i, within sector j, will cope with the following marginal costs (I assume there are not fixed costs of production in this first simple framework):

$$mc_{ijk}^{D} = \frac{W_i}{A_i z_{jk}}. \tag{47}$$

On the other hand, firms willing to sell abroad have to cope with not only (marginal) production costs but also with international trade costs. The latter are assumed to be of two different types. First, every firm wishing to export any amount of its output to the other country has to pay a fixed labour costs, F_x. Second, exporting firms' marginal costs will be scaled up by an iceberg type costs, $D \geqslant 1$. Notice that such international costs, of both fixed and iceberg type, are constant over time and must be faced each time a firm wants to export. Therefore, the marginal costs faced by a firm placed in country 1, sector

j, and with productivity z_{jk} wishing to sell part of its output to country 2 is equal to

$$mc_{1jk}^{F} = \frac{DW_1}{A_1 z_{jk}}. \tag{48}$$

Indeed, if $D = 1$, then the marginal costs faced to sell both at home and abroad are equal. Finally, the total number of firms selling to each sector is determined endogenously in equilibrium. I assume that all the firms sell in the respective domestic country, as they do not have to deal with fixed costs of production, so that the minimum number of competitors within each sector is exogeneous and is equal to K. However, among the further K potential sellers from abroad, it can happen that not all of them are able to cover the fixed costs of export and then make nonnegative profits by exporting. Thus, the total number of sellers to one sector can be lower than $2K$ in equilibrium.

Profit maximization and price setting

Firms producing individual goods are engaged in imperfect competition. More specifically, firms play a static game of quantity competition. Each of them chooses the quantity q_{ijk} to sell in country i taking as given the quantities chosen by all the other firms in the economy, along with the respective domestic wage rate W_i , the final consumption quantity c_i and the aggregate price P_i. Indeed, firms are assumed to be aware that their choice about q_{ijk} affects the sectoral aggregate price P_{ij} and the sectoral aggregate production y_{ij}.

Domestic firms

I first solve for equilibrium prices and quantities for the domestic firms. I assume that in each sector there are only K domestic firms producing and selling. As an example, I take sector j in country 1: the vector of prices P_{1jk} and quantities q_{1jk} for firms $k = 1, 2..., K$, are equilibrium prices and quantities in sector j if, for each firm in that sector, the quantity q_{1jk} and the price P_{1jk} result to be the solutions to the following maximization problem :

$$\max_{p_{1jk}, q_{1jk}} p_{1jk} q_{1jk} - q_{1jk} \frac{W_1}{A_1 z_{jk}}, \tag{49}$$

subject to the following inverse demand function derived from (42) and (45):

$$\frac{P_{1jk}}{P_i} = \left(\frac{q_{1jk}}{y_{1j}}\right)^{-\frac{1}{\rho}} \left(\frac{y_{1j}}{c_1}\right)^{-\frac{1}{\eta}} u_{1j}, \tag{50}$$

where y_{1j} is given by (43). Notice that, in the maximization problem, aggregate price, P_1, final consumption, c_1, and the quantities produced by the other competitors in sector j, q_{1lk}, with $l \neq k$, are taken as given. Moreover, the oligopolistic structure at the sector level ensures the endogeneity of markups, even though such an endogeneity could have been obtained according to alternative ways (see Feenstra, 2003, and Melitz and Ottaviano,

2008.) [28]

Thus, in sector j, equilibrium prices are found by solving a system of K nonlinear equations, that are given by the first-order conditions of the profit maximization problem:

$$P_{1jk} = \frac{\varepsilon(s_{1jk})}{\varepsilon(s_{1jk}) - 1} \frac{W_1}{A_1 z_{jk}}, \tag{51}$$

where

$$\varepsilon(s_{1jk}) = \left[\frac{1}{\rho} (1 - s_{1jk}) + \frac{1}{\eta} s_{1jk} \right]^{-1}, \tag{52}$$

and s_{1jk} is the market share of firm k within sector j (country 1), that is

$$s_{1jk} = \frac{P_{1jk} q_{1jk}}{\sum_{l=1}^{K} P_{1jl} q_{1jl}}.$$

From (45) and (44), I can express the market share as a function of prices:

$$s_{1jk} = \frac{(P_{1jk})^{1-\rho}}{\sum_{l=1}^{K} (P_{1jl})^{1-\rho}}. \tag{53}$$

In solving the system of equations, W_1, A_1 and the firm level productivities, z_{jk} are taken as given. Needless to say, the procedure described above to find equilibrium prices in sector j in country 1 is the same for all the sectors in both the countries, 1 and 2.

Adding foreign firms

The number of foreign competitors within each sector is determined according to a dynamic multistage game solved by backward induction, with firms deciding in each period whether and how much to export. As I said before, differently from domestic competitors, foreign sellers have to deal with iceberg marginal costs and fixed costs of export: this means that they enter the foreign market only if they can cover the fixed costs of export and make nonnegative profits. The levels of wages in the two countries, W_i, final consumption, c_i, and aggregate price, P_i are taken as given during the procedure; they are determined in general equilibrium. Foreigners are assumed to be ordered according to a reverse order of unit costs, that is from the most productive to the least productive. As I did before, I use sector j in country 1 to illustrate the procedure. Each entrant $K+n$, with $n \in [1, K]$, plays a simultaneous-move game of quantity competition. Equilibrium prices are calculated through a system of $K + n$ nonlinear equations: in more detail, the first K equations are related to the domestic firms (51), while the following n equations are related to the prices that the first n entrants in sector j from country 2 charges to country 1 consumer. In

[28] Feenstra (2003) introduced a translog expenditure function within a monopolistic competition model, that also yields demand elasticities depending on the prices and the number of competing goods. Moreover, Melitz and Ottaviano (2008) used quasilinear preferences over a continuum of differentiated varieties and obtained that a larger number of varieties results in a decrease in the price elasticity of demand.

more detail, the price charged by the nth entrant is equal to

$$P_{1jK+n} = \frac{\varepsilon\left(s_{1jK+n}\right)}{\varepsilon\left(s_{1jK+n}\right)-1}\frac{DW_2}{A_2 z_{jK+n}}.$$

Once I have calculated the equilibrium prices, I can calculate the sectoral price (44); then, I can derive the amount exported by firm $K+n$, by using (42), (45) and $P_1 c_1^{\eta}$ (the latter is used to calculate the sectoral output.) Then, I can calculate the profit earned by the nth entrant: if it does not cover the fixed cost of export, $W_2 F_x$, then in equilibrium there will be $K+n-1$ competitors.[29]Therefore, this procedure, that has to be repeated in both the countries, sector by sector, yields the final number of competitors in each sector (including exporters) and a set of equilibrium prices P_{ijk} given fixed wages, aggregate prices and quantities (that are calculated in general equilibrium, as explained next). Furthermore, note that, given the prices calculated through the procedure described below, weights exogeneously scale the quantity that each firm can sell to each one of the two markets (i.e. domestic and foreign). Thus, they also determine the amount of profits that firms can make and, particularly, the possibility to export. For example, the larger country 1' share of consumption on sector j, the larger the quantity of its specific product that each firm can sell to that sector, the larger the chances to cover fixed costs of exports due to larger revenues and profits.

General equilibrium

The model is solved statically at every date for the general equilibrium prices and quantities, as a function of the realized productivity shocks at the aggregate level, that are A_1 and A_2. The problem consists of finding a fixed point in the aggregate variables, P_i, c_i, W_i, l_i, with $i = 1, 2$, using W_2 as a numeraire. The solution to this problem is found as follows. I first derive the number of competitors and prices in each sector in the two countries taking $P_1^{\eta} c_1$, $P_2^{\eta} c_2$, and W_2 as given. Then, I can calculate aggregate and sectoral prices according to, respectively, (41) and (44); furthermore, I can calculate quantities produced by each firm through (42) and (45). Aggregate labour demand (L_1 and L_2) is derived by summing up the labour demand of all the firms (also considering the fixed costs of export). Thus, the fixed point in the aggregate variables are found when the three first order conditions (38) and (39) result to be satisfied.

How does the model generate Pricing-to-Market ? Explanation

I assume that $\rho > \eta$. This implies that each firm's markup over its marginal costs is an increasing function of the market share hold by that firm within its sector. As I can see in the elasticity formula (52), if the market share approaches to zero, then the firm only faces

[29]Note that each entrant only takes into account the already existing competitors, along with which, simultaneously, it sets its price. Thus, entrants do not look at the effect of their entry decision on the total number of firms within their sector; the latter is endogeneosuly determined at the end of the selection process.

the sectoral demand elasticity ρ and imposes a markups equal to $\rho/(\rho-1)$. However, if the market share tends to one, than the firm faces a lower demand elasticity, that is η, so that it will be able to impose a larger markup, that is $\eta/(\eta-1)$. Therefore, it turns out that for a sectoral market share between zero and one, the markup is increasing in the market share. Furthermore, the assumption $\rho > \eta$, along with the other assumption of a finite number of competitors within each sector, that is $K < \infty$, leads to incomplete pass-through of changes in costs to prices. Specifically, if an individual firm or a group of firms deal with an increase in marginal costs relative to the other competitors within the same sector (this can happen because aggregate productivities in the two countries might change over time, affecting foreign competitors within the same sector in a different way), then this will lower the market share and, consequently, the markup in equilibrium. Thus, the increase in price will be lower than the increase in marginal costs.

However, imperfect competition with variable markups is a necessary but not sufficient condition in order to have pricing-to-market: in fact, without any trade costs, firms have to face the same competitors both abroad and at home, so that they will have the same markups and charge and the same prices in both the markets.

4.2.2 A more complicated case: heterogeneous preferences, fixed costs of production, and home bias

In the following section, I am presenting a more complicated extension of AB (2008), that consists in introducing the home bias effect through combining fixed costs of production with heterogeneous demand preferences across countries. In particular, such an effect (as shown in Krugman, 1980) implies that, in presence of increasing returns, firms will be more oriented to produce and sell those goods for which there are larger domestic markets. So, differently from the model presented in 4.2.1, not only exporters but also domestic sellers have to deal with entry costs. Therefore, both the number of domestic sellers and the number of foreign sellers will be endogeneously determined through a dynamic multistage game solved by backward induction.

Production

Firms produce according to a constant returns to scale function employing labour as the only input. The production function of a firm takes the same form as in (46). In this new case, all firms have to deal with fixed costs of production, F_p, that will impose entry selection to all competitors. Thus, those firms that are not able to make profits enough to cover such costs, will not produce and sell in the domestic market and in the foreign one either.

On the one hand, a firm with productivity z_{jk} selling to the domestic market i, within sector j, will cope with both fixed costs of production, F_p, and the same marginal costs as in (47). On the other hand, firms willing to sell abroad have to cope with not only

production costs (both fixed and marginal) but also with international trade costs. As before, the latter are assumed to be of two different types. First, every firm wishing to export any amount of its output to the other country has to pay a fixed labour costs, F_x. Second, exporting firms' marginal costs will be scaled up by an iceberg type costs, $D \geqslant 1$. Therefore, the marginal costs faced by a firm placed in country 1, sector j, and with productivity z_{jk} wishing to sell part of its output to country 2 is the same as in (48). Moreover, notice that both the fixed costs of production, F_p, and costs of exporting, that are D and F_x, are constant over time and must be faced each time firms are willing, respectively, to produce or export.

Finally, the total number of firms selling to each sector is determined endogenously in equilibrium. As all the firms have to face fixed costs of production, both the number of domestic competitors and the number of foreign competitors depends on the ability of entrants to the market to cover fixed costs of production. Indeed, the selection for foreigners will be always tougher than for domestic competitors as long as they have also to pay fixed costs of exports. Therefore, in equilibrium, the number of total competitors within each sector is included in the interval $[0, 2K]$, as there can be up to a max of K domestic firms and up to a max of K foreign competitors.

Profit maximization and price setting

As in the simple case described before, firms producing individual goods are engaged in imperfect competition. More specifically, firms play a static game of quantity competition. Each of them chooses the quantity q_{ijk} to sell in country i taking as given the quantities chosen by all the other firms in the economy, along with the respective domestic wage rate W_i , the final consumption quantity c_i and the aggregate price P_i. Indeed, firms are assumed to be aware that their choice about q_{ijk} affects the sectoral aggregate price P_{ij} and the sectoral aggregate production y_{ij}.

Domestic firms

I first solve for equilibrium prices and quantities for the domestic firms. The number of domestic competitors (here intended as sellers) within each sector is determined according to a dynamic multistage game solved by backward induction, with firms deciding in each period whether to enter the market and how much to sell. The levels of wages in the two countries, W_i, final consumption, c_i, and aggregate price, P_i are taken as given during the procedure and are determined in general equilibrium. Moreover, domestic competitors are assumed to be ordered according to a reverse order of unit costs, that is from the most productive to the least productive. In particular, during the selection of domestic firms, all the potential competitors from abroad are assumed to be active, so that each domestic firm will have to face at least K (foreign) sellers. In this way, I reproduce also for domestic firms the entry conditions assumed in the previous simple case for foreign competitors (in that case, all the domestic firms were assumed to be active during the selection of exporters).

So, as I did before, I use sector j in country 1 to illustrate the procedure. Each entrant m, with $m \in [1, K]$, plays a simultaneous-move game of quantity competition: equilibrium prices are calculated through a system of $K + m$ nonlinear equations. On the one hand, the first K equations are related to prices charged by country 2 firms sector j of country 1:

$$P_{1jk} = \frac{\varepsilon\left(s_{ijk}\right)}{\varepsilon\left(s_{ijk}\right) - 1} \frac{DW_2}{A_2 z_{jk}} \quad \text{for} \quad k = 1, 2, ..., K,$$

where $\varepsilon\left(s_{ijk}\right)$ is as in (52) and s_{ijk} as in (53). On the other hand, the other m equations refer to the prices that the first m domestic entrants in sector j charge; more specifically, the mth firm will charge:

$$P_{1jK+m} = \frac{\varepsilon(s_{1jK+m})}{\varepsilon(s_{1jK+m}) - 1} \frac{W_1}{A_1 z_{jK+m}}.$$

Once I have calculated the equilibrium prices, I can calculate the sectoral price by (44); then I can derive the amount sold by the mth lowest unit costs domestic firm, q_{1jK+m} by using (42), (45) and $P_1^{\eta} c_1$ (the latter is used to calculate sectoral output). Therefore, I can calculate the profit earned by the mth domestic firm in sector j of country 1: if this does not cover the fixed costs of production, that is $W_1 F_p$, then, in equilibrium, there will be $K + m - 1$ firms in sector j of country 1, i.e. K foreign firms and $m - 1$ domestic firms. Thus, this procedure, repeated in both the countries, sector by sector, yields the final number of domestic competitors in all sectors, that I indicate with $M_{ij} \in [0, K]$, and a set of equilibrium prices P_{ijk} given fixed wages, aggregate prices and quantities (that are calculated in general equilibrium). Furthermore, note that, given prices calculated according to the procedure just described, weights exogeneously scale the quantity that each firm can sell. Thus, they also determine the amount of profits that firms can make and, particularly, the possibility to produce anything. For example, the larger country 1' share of consumption on sector j, the larger the quantity of its specific product that each firm can sell to that sector, the larger the chances to cover fixed costs of production due to larger revenues and profits.

Adding foreign firms

Once I have derived the number of domestic competitors sector by sector in the two countries, I turn to determining the number of exporters according to a procedure that is similar to what used in the previous simple case with no fixed costs of productions. The main difference with that case is the number of domestic firms in each sector: one the one hand, it is calculated endogenously in the manner showed before (in the previous case, it was assumed to be always equal to K); on the other hand, it can differ across sectors and countries due to different distributions of productivities across sectors and preference weights across sectors and countries.

Thus, differently from the simple case, foreign sellers have to deal not only with iceberg marginal costs and fixed costs of export, but also with fixed costs of production: this means that they enter the foreign market only if they can cover the sum of fixed costs of production and fixed costs of export and make nonnegative profits. As before, the levels of wages in the two countries, W_i, final consumption, c_i, and aggregate price, P_i are taken as given during the procedure and are determined in general equilibrium. Foreigners are assumed to be ordered according to a reverse order of unit costs, that is from the most productive to the least productive. Again, I use sector j in country 1 to illustrate the procedure. Each new exporter, n, with $n \in [1, K]$, plays a simultaneous-move game of quantity competition. Equilibrium prices are calculated through a system of $M_{1j} + n$ nonlinear equations. In more detail, the first M_{1j} equations are related to domestic firms (51), while the other n equations refer to the prices that the n most productive exporters charge. More specifically, the nth least unit cost exporter will charge

$$P_{1jM_{1j}+n} = \frac{\varepsilon\left(s_{1jM_{1j}+n}\right)}{\varepsilon\left(s_{1jM_{1j}+n}\right) - 1} \frac{DW_2}{A_2 z_{jM_{1j}+n}}.$$

Once I have calculated the equilibrium prices, I can calculate the sectoral price by (44); then I can derive the amount exported by the nth exporter $q_{1jM_{1j}+n}$, by using (42), (45) and $P_1^{\eta} c_1$ (the latter is used to calculate sectoral output). So, I can now calculate the profit earned by the nth most productive seller in sector j from country 2: if this does not cover the fixed costs of productions plus the fixed costs of export, that is $W_2\left(F_p + F_x\right)$, then, in equilibrium, there will be $M_{1j} + n - 1$ firms selling to sector j in country 1. Therefore, this procedure, repeated in both the countries, sector by sector, yields the final number of competitors in each sector (including exporters) and a set of equilibrium prices P_{ijk} given fixed wages, aggregate prices and quantities (that are calculated in general equilibrium, as explained next). Also in this case, given the prices calculated through the procedure described below, weights exogeneously scale the quantity that each firm can sell to each one of the two markets (i.e. domestic and foreign). Thus, they also determine the amount of profits that firms can make and, particularly, the possibility to export.

General equilibrium

The general equilibrium is calculated in the same fashion as in the simple case described before. Thus, the fixed point in the aggregate variables is found when the three first order conditions (38) and (39) result to be satisfied.

4.3 Numerical results

4.3.1 Construction of demand preferences

In order to implement numerical exercises aimed at verifying the effectiveness of the two extensions to AB (2008) introduced above, I first need to proxy country level demand preferences. So, I choose to use the CPI weights provided in the OECD database.[30] These weights represent the shares of household final consumption on different goods. As explained in the Introduction of this chapter, by exploiting the most disaggregated classes of products available in the database (four-digit C.O.I.C.O.P), I can collect data on the CPI weights for 58 products (they are listed in the Appendix). These products are grouped in 7 broader categories: Food, Housing, Apparel, Transport and Communication, Medical Care, Education and Recreation and Other goods.[31] I collect data for the US, and some of its major trade partners: Canada, Germany, Japan, Mexico, the UK. In the numerical simulations of the two-country model I set up, demand preferences of "country 1" will be proxied by US CPI weights, while demand preferences of "country 2" will proxied by CPI weights of each of the US trading partners selected.

Following I explain how I built up the demand preferences $\{u_{ij}\}_{i=1,2;j=1,S}$ used in my numerical tests. For each country, $i = 1, 2$, and for all those categories, that I index by $f = 1, 2, ..., 7$, I extract the mean, μ_{if}, and the standard deviation, θ_{if}, of the weights included.[32] Then, I split the number of sectors used in my numerical exercises, S, into 7 equal parts: so, each parts contains $S/7$ sectors.[33] Each of these parts represents one of the categories that I use to group the products. For each country and for each of the 7 parts, I draw weights from a log-normal distribution, whose mean and standard deviation have been calculated before, that is $\log u_{ij_f} \sim N\left(\mu_{if}, \theta_{if}\right)$. Finally, I rescale all the weights previously drawn so that the sum of weights in each part is equal to the actual aggregate CPI weight (reported in Table 4.2) and, consequently, the sum of all the weights at the country level is equal to one. Specifically, weights used in the numerical exercises result to be equal to:

[30] I have also tried to employ more detailed CPI weights as proxies. Particularly, for the U.S., I used weights representing relative importance in the CPI (U.S. city average, December 2001). Those weights are provided by the U.S Bureau of Labor Statistics. For Japan, instead, I collected data on the weights related to items of the 2000-Base CPI from the Japanese Statistic Bureau, Director General for Policy Planning and Statistical Research and Training Institute. Nevertheless, results were not that different from those that I am presenting here. Furthermore, the OECD database gives me the opportunity to use the CPI weights of more countries and, crucially, to compare those weights as they are always related to the same panel of goods. In fact, one of the issues implied by the use CPI weights provided by national statistical institutes was that the panel of items chosen to build up CPI indeces can actually differ.

[31] Those categories are also used for the construction of most of the national CPI weights.

[32] The values of μ_{if} and θ_{if} are reported in the Appendix.

[33] When S is not perfectly divisible by 7, then I round the number of elements of the first 6 parts to the nearest integer less than or equal to $S/7$. So, in the last part, I include all the remaining sectors from the starting S ones.

$$u_{ij} = \frac{u_{ij_f}}{\sum_{s_f=1}^{S/7} u_{is_f}} \text{ (actual CPI weight)}, \; with \; f = 1, .., 7; j = 1, ...J; i = 1, 2; s_f \neq j_f.$$

4.3.2 The simple case: heterogeneity in demand preferences

I first present the results of numerical exercises that test the first and simpler extension of AB (2008) I propose, i.e. the introduction of cross-country demand preference heterogeneity. As I said, the main target is to get closer to the actual data about volatility of manufacturing international relative prices. In more detail, the standard deviation of CPI/CPI^* relative to PPI/PPI^* for the US is equal to 1.08 in the period 1985-2006, so that the major aim of my work it to take the original framework as close as possible to that value (without worsening the other results).[34]

In order to test the effectiveness of the model that I set up, I first need to set the values of the parameters on both the demand and the production side. On the demand side, I have already illustrated before how I construct the demand preferences at the sector level $\{u_{ij}\}_{j=1,..,J;i=1,2}$; furthermore, the two parameters in household's utility function are set according to a standard fashion: β equal to 0.96 and μ equal to 2/3. Turning to the production parameters $(S, K, \eta, \rho, \theta, D, F)$, they are set as in AB (2008), in order to make my results directly comparable with those in the original framework. S is equal to 20,000 and K is equal to 20; thus, in numerical simulations, in each country there are 400,000 firms and 20,000 sectors. The latter are interpreted as more disaggregated with respect to ten-digit NAICS (North American Industry Classification System) sectors, that actually amount to 10,000. In terms of demand elasticities, η is set equal to 1.01, so that sectoral expenditure shares are kept almost constant; ρ is chosen equal to 10, that is at the high extremity of the range (5 to 10) empirically found by Anderson and van Wincoop (2004) for the elasticity of demand for imports at the sectoral level. The setting of the other parameters (θ, D and F) is chosen to make the model, in the symmetric equilibrium (i.e. $A_1 = A_2$), able to reproduce the actual data in the US on the overall volume of trade, the percentage of exporters and the level of industry concentration at the sector level. So, the first economic value concerning the US economy that I want to target is the average of exports relative to gross output in manufacturing sectors in the period 1997-2003. According to OECD databse, that ratio was equal to 11.7 percent in 1997 and 21 percent in 2003: thus, on average, the value of the ratio was equal to

[34] PPI is the manufacturing producer price index for the U.S.; PPI* is the trade-weighted producer price index for U.S. trading partners; CPI is the consumer price index for U.S. goods in the period 1985-2006; CPI* is the trade-weighted consumer price index for U.S. 1985-2006 trading partners). Furthermore, data on U.S. PPI and CPI are taken from BLS; data on PPIs and CPIs for trading partners are mostly taken from OECD and IFS databases. Exceptions: Japanese PPI (from Bank of Japan), U.K. PPI (from UK National Statistics), Mexican and South Korean CPIs and PPIs (from, respectively, Banco de Mexico and Bank of Korea).

about 16.5 percent. The second value targeted is the share of US manufacturing plants that export in the period 1987-1992, that is 25 percent. In more detail, the latter is the average of the fraction of exporters over total plants in 1987 (21 percent) and in 1992 (30 percent), according to Bernard and Jensen (2004). Finally, the third economic value that I try to match in my numerical exercises is the median Herfindahl index across sectors equal to 1,500[35]. The US Census Bureau, in 1997, calculated that the median Herfindahl index across 473 six-digit NAICS industries, was equal to 571, while the average of the Herfindahl indeces across the same industries was 737. As said before, sectors used in the model are interpreted as at a lower level of disaggregation with respect to NAICS sectors, at which a higher level of concentration can be expectable. Moreover, the choice of the value 1,500 makes the median sector definable, according to the US Department of Justice, as "moderately concentrated". Therefore, the standard deviation of firm level productivity distribution, θ is set equal to 0.385, while the fixed costs of export, F, are chosen equal to 0.0003; finally, D, i.e. the iceberg type marginal cost of exporting, is set at the value of 1.45, following the evidence reported in Anderson and van Wincoop (2004). In the Appendix, I provide details about how I construct variations to price indeces, i.e. $\widehat{CPI}_1$, $\widehat{CPI}_2$, $\widehat{PPI}_1$, $\widehat{PPI}_2$.

Following in Table 4.3, I am presenting the results from the numerical exercises that test my first extension to AB (2008).[36] The test consists in measuring how much international relative prices change in equilibrium after a negative shock to aggregate productivity in country 1, that is A_1, such that aggregate costs in country 1, W_1/A_1, relative to aggregate costs in country 2, W_2/A_2, increase by 1 percent. Indeed, as long as W_2 is chosen as a numeraire, the aggregate costs in country 2 do not change after this shock.

So, from the results reported, it comes out that introducing preference heterogeneity both across sectors and across countries does not lead any improvement in terms of the target variable (i.e. the volatility of CPI-based RER with respect to the volatility of PPI-based RER). This means that variable keeps almost the same gap from the unity as in the benchmark case, where preferences are assumed to be homogeneous. The tests are implemented on 20,000 sectors such as in AB (2008) and all the common parameters (i.e. $K, \theta, \eta, \rho, D, F_x$) are set at the same values as in the original framework. Thus, the only difference with the latter is the heterogeneity in preferences. Country 1 preferences are always proxied with US CPI weights in 2000, while country 2 preferences are proxied with CPI weights of some of the US major trading partners: Canada, Germany, Japan, Mexico

[35]Note that the Herfindahl index relative to a sector is the sum of the squared market shares held by firms within that sector, multiplied by 10,000.

[36]It might be worth mentioning how I solve the nonlinerar systems of price equations. This is to eventually justify some (small) discrepancies between my numerical results in the benchmark case and numerical results in AB (2008). I use the trust-region dogleg method implemented by the software Matlab. In more detail, the algorithm is a variant of the the Powell dogleg method. Furthermore, the starting point is calculated in a full symmetric system, where nobody exports.

and the UK. The countries chosen to represent country 2 in the numerical exercises have different degrees of heterogeneity in preferences with respect to the US, as shown in Table 4.2. Furthermore, as evidenced before, US trading partners also show different degrees of heterogeneity in preferences across CPI categories. So, both proxying country 2 with countries that are very similar in preferences with respect to the US (such as Canada) and proxying country 2 with countries that are really different from the US from the same point of view (such as Mexico, Japan) yield almost no change in terms of movements of CPI-based RER relative to movements of PPI-based RER after aggregate shocks with respect to the original framework. Nevertheless, preference heterogeneity seems to matter more in terms of extensive and intensive margins. In particular, in all the heterogeneous preferences cases tested, the ratio (in percentage terms) of exporters to the total number of domestic producers results to be lower than in the benchmark case. In detail, the lowest export margin is found when country 2 is proxied with Canada, that is both the most similar country in terms of preferences to the US and the US trade partner with the largest standard deviation across categories of CPI preferences (see Table 4.2). Moreover, the largest extensive margin is related to the case in which country 2 is proxied by the UK which, among the US trading partners selected, is that one with the lowest standard deviations across categories of CPI weights. Therefore, it seems that it is harder to export to those countries where preferences are more concentrated in some sectors than in others. The intuition is that if consumption tends to concentrate in some sectors, the other ones will result to be so thin that only a few exporters will be able to enter those sectors. However, sectors to which very large preference are associated, are not able to offset the previous effect by letting a relatively larger number of exporters enter the market. Moreover, preference heterogeneity also turn out to affect the intensive margin. As for the extensive margin before, the lowest value comes out when country 2 is proxied with Canada, while the largest value (15.4977 percent) when country 2 is proxied with the UK (14.0228 percent). Finally, in terms of market concentration across sectors, the median of Herfindahl index across sectors does not change so much when preference heterogeneity is introduced. More specifically, in all the five case with heterogeneity in preferences the value of the index $(1,473)$ is just slightly larger than in the benchmark case $(1,463)$: this is because the number of exporters from country 2 to country 1 is lowered by the introduction of preference asymmetry. Thus, because there are fewer competitors (from abroad) in country 1, the marker concentration across sectors result to be a little larger.

Table 4.3. Heterogenous preferences case:
implications of 1 percent increase in $(W_1/A_1)\,/\,(W_2/A_2)$

	Heterogeneous preferences					Ho.P.[37]	Actual
Country 1	US	US	US	US	US		Data
Country 2	Canada	Germany	Japan	Mexico	UK		
Parameters							
S	20,000	20,000	20,000	20,000	20,000	20,000	
K	20	20	20	20	20	20	
θ	0.385	0.385	0.385	0.385	0.385	0.385	
η	1.01	1.01	1.01	1.01	1.01	1.01	
ρ	10	10	10	10	10	10	
D	1.45	1.45	1.45	1.45	1.45	1.45	
F_x	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
Results							
$\frac{\widehat{CPI}_1-\widehat{CPI}_2}{\widehat{PPI}_1-\widehat{PPI}_2}$	0.8369	0.8374	0.8376	0.8371	0.8374	0.8379	1.08
Ext. M.(%)[38]	21.843	22.5275	22.5987	22.2985	22.7662	24.7877	25.00
Int. M.(%)	14.0228	14.6346	14.9329	14.6953	15.4977	14.0500	16.5
M.H.Index	1,473	1,473	1,473	1,473	1,473	1,463	*n.a.*

4.3.3 The more complicated case: heterogeneous preferences, fixed costs of production, and home bias.

Before starting with numerically testing the model that I built up, I perform a mapping exercise aimed at pursuing two aims. The first one is to quickly understand whether introducing fixed costs of production can really affect the predictions in AB (2008). The second one is to find out those values of fixed costs of production for which the ability of the model to match the volatility of CPI-based real exchange rate with respect to volatility of PPI-based real exchange rate could be improved, without worsening too much the other results in terms of marginal and intensive margins.

Figure 4.3 shows that introducing fixed costs of production is able to increase the ratio of changes in CPI-based RER to changes in PPI-based RER. Specifically, it comes up that the largest the fixed costs, the larger the value of the ratio predicted by the model. Figure 4.4, instead, shows that the extensive margin, i.e. the ratio (in percentage) of exporters to all domestic producers, is also affected by such fixed costs. For low values of fixed costs, the export ratio predicted turns out to be larger than those found in actual data. For values larger than 0.0007, the export ratio seems to be, roughly, back to the

[37] Ho.P.=Homogeneous preferences. As in AB (2008), preferences are equal both across sectors and across countries.

[38] Abbreviations: Ext. M.= Extensive Margin; Int. M.=Intensive Margin; M.H.Index=Median Herfindahal Index.

actual data amount. Finally, from Figure 4.5, it results that the larger the fixed costs of production, the lower the intensive margin, that is the ratio (in percentage) of exports to manufacturing gross output. However, at fairly large values of fixed costs, the intensive margin results to be lowered at not more than 1 percent. So, from this simple exercise, it seems that introducing such costs into the model could improve the results from the original framework: for relatively large values of F_p, the ratio of changes in CPI-based RER to changes in PPI-based RER is increased, without changing so much in terms of both extensive and intensive margin.

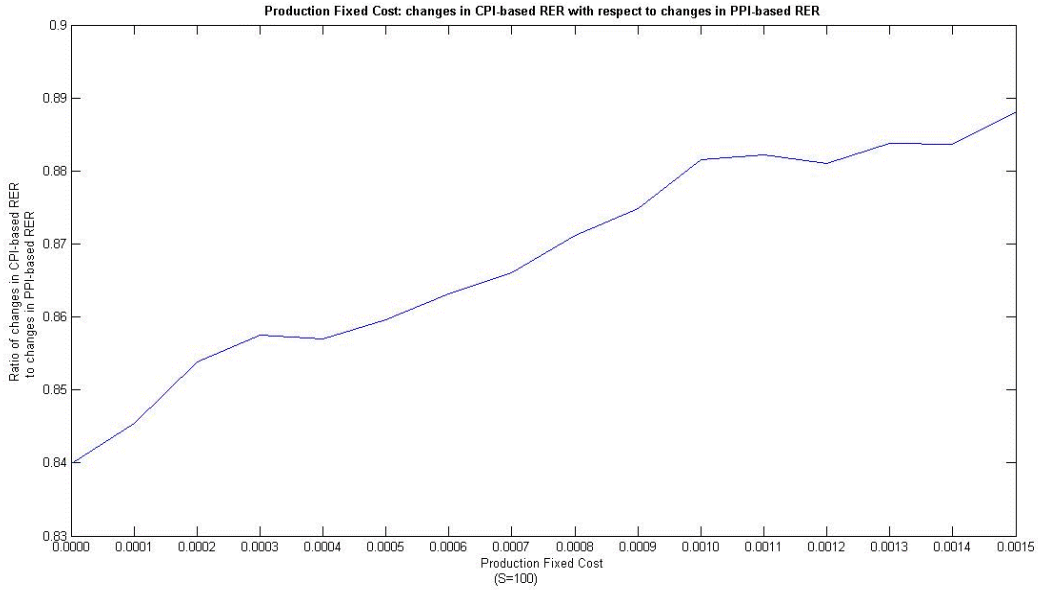


Figure 4.3. Fixed costs of production and PTM

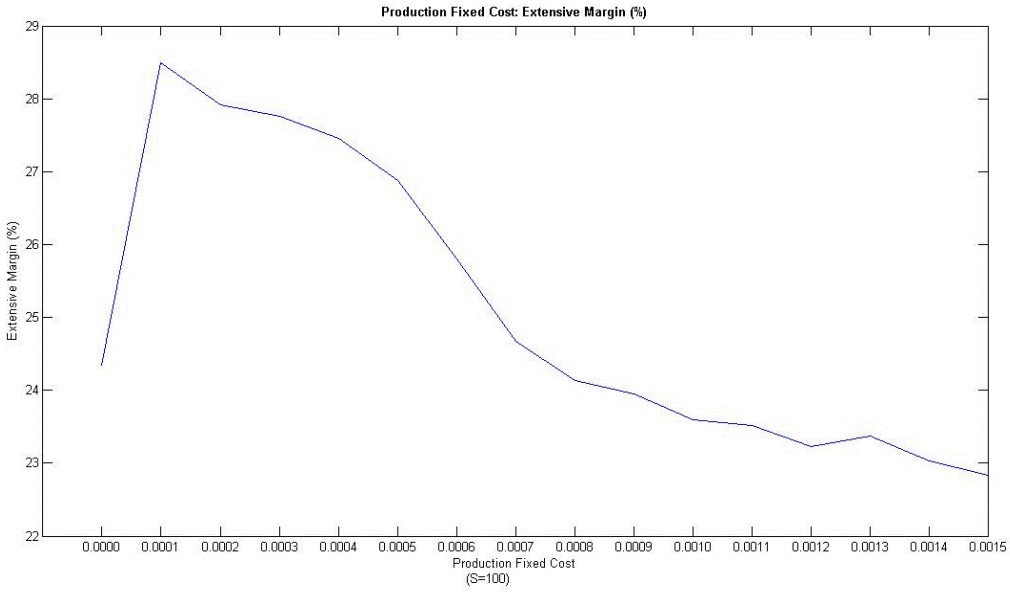


Figure 4.4. Fixed costs of production and extensive margin

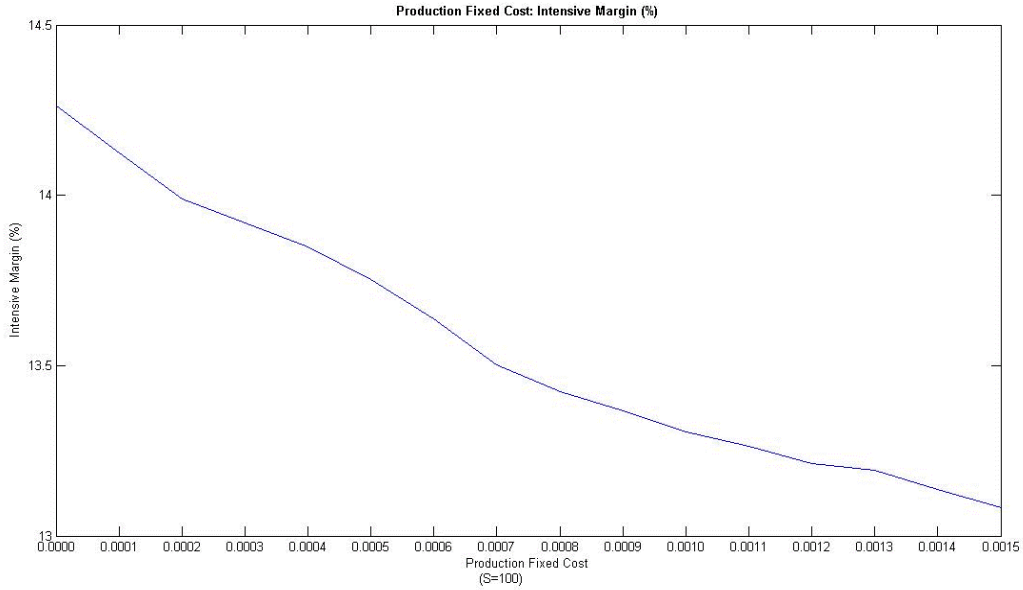


Figure 4.5. Fixed costs of production and intensive margin

In Table 4.4 below, I am reporting the results from the numerical exercises that test the second and more complicated extension to AB (2008), which introduces fixed costs of production other than preference asymmetry. Even in this case, the test consists in measuring how much international relative prices change in equilibrium after a negative shock to aggregate productivity in country 1, that is A_1, such that aggregate costs in country 1, W_1/A_1, relative to aggregate costs in country 2, W_2/A_2, increase by 1 percent.

It results that adding positive fixed costs of production to the original setting can lead to an improvement in terms of ability of the model to predict the actual reaction to aggregate shocks of CPI-based RER relative to the reaction of PPI-based RER. In fact, the ratio of changes in CPI-based RER to changes in PPI-based RER is equal to 0.8762, that is closer to the unity with respect to homogeneous preference/no fixed costs of production case (0.8379). As for the simpler case, the tests are implemented on 20,000 sectors such as in AB (2008) and all the common parameters (i.e. $K, \theta, \eta, \rho, D, F_x$) are set at the same values as in the original setting. In addition, according to the same rationale used in the original setting, the fixed costs of production, i.e. F_p, are set at the value (0.0012) that allows the model to match the extensive margin, the intensive margin and the degree of market concentration across sectors in the US economy. So, in the benchmark case, that in this case includes positive fixed costs of production and preference symmetry, the main target seems to be closer than before. In terms of matching other US actual data, the extensive margin results to be almost unchanged after the introduction of fixed costs. The ratio of exporters to total domestic producers is just a little lower (24.5370 percent) than before (24.7877 percent), as producers selling abroad have now to deal with two types of fixed costs that are summed up: fixed costs of production, F_p, and fixed costs of exporting, F_x. Thus, in this case, the "barrier" to exporting turns out to be higher. Nevertheless, the extensive margin keeps being really close to actual data (25 percent) because not just the number of exporters in the economy falls but the number of total producers itself. In fact, nobody now can produce and sell anything as long as it is not able at least to cover the positive fixed costs of production, F_p. The (little) change in the number of competitors also lead to a (slight) increase in value of the median of the Herfindahl index $(1,533)$, that keeps being very close to actual data $(1,500)$. The only value that seems to be more heavily changed with respect to the zero fixed costs of production case is the intensive margin that, as expected from the results of the mapping exercise, comes out to be lowered to 12.9649 percent. However, the latter value is far in between the low (11.7 percent) and the high (21 percent) ends of the range from which the actual value I refer to is drawn from. The next tests consider not only the fixed costs of production but also preference asymmetry. As in the previous case, country 1 preferences are always proxied with US CPI weights in 2000, while country 2 preferences are proxied with the CPI weights of some of the US top trading partners: Canada, Germany, Japan, Mexico and the UK. Thus, preference heterogeneity turns out to never give better outcomes than preference homogeneity in this case too. Such as in the simpler framework, on the one hand, the lowest extensive margin (23.1812 percent) outcome is related to the case in which, in terms of preferences, country 2 is proxied with Canada, that reports the largest heterogeneity across categories of CPI preferences. Furthermore, the lowest ratio of exporters to total producers is also associated to the lowest intensive margin (13.1029 percent) and, in addition, to the lowest ratio of

changes in CPI-based RER to changes in PPI-based RER (0.8684). The latter might be explained with the fact the lower the number of exporters in the economy, the lower the impact of pricing-to-market on the aggregate economy, as long as firms selling only in the domestic market can not charge different prices across different (national) markets. On the other hand, the largest extensive margin value (24.2024 percent) is found in the case in which country 2 is proxied by the UK that, among the US trading partners selected here, reports the lowest standard deviation across categories of CPI weights. The largest share of exporters also implies the largest trade volume (14.4532 percent) and corresponds to the second (after Japan) largest value or the target variable (0.8708). In this case, a larger number of exporters means a larger number of producers that can charge different prices across the two different markets where they sell their products; this leads to a larger impact of pricing-to-market on international aggregate prices. Tests with country 2 preferences proxied by CPI weights of Germany and Japan yield results fairly similar to those obtained in the previous case, where country 2 is represented by the UK: in the first case the target value takes on value 0.8707, while in the second case value 0.8710. Finally, it can also be observed that the value of the median Herfindahl index increases when I add preference heterogeneity to fixed costs of production. The value of the median turns out to be larger than 1,580 in all the five cases of heterogeneity, while it is equal to 1,533 in the benchmark case with homogeneous preferences. This might be due to the tougher selection at the entry that preference asymmetry and fixed costs of production together impose at the entry, especially in the smaller (i.e. with lower expenditure preference weights) sectors. This effect is not offset by a softer selection in larger sectors.

Table 4.4. Fixed costs of production and heterogeneous preferences: implications of 1 percent increase in $(W_1/A_1)\,/\,(W_2/A_2)$

	Heterogeneous preferences					Ho.P.[39]	Actual
Country 1	US	US	US	US	US		Data
Country 2	Canada	Germany	Japan	Mexico	UK		
Parameters							
S	$20,000$	$20,000$	$20,000$	$20,000$	$20,000$	$20,000$	
K	20	20	20	20	20	20	
θ	0.385	0.385	0.385	0.385	0.385	0.385	
η	1.01	1.01	1.01	1.01	1.01	1.01	
ρ	10	10	10	10	10	10	
D	1.45	1.45	1.45	1.45	1.45	1.45	
F_p	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	
F_x	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
Results							
$\frac{\widehat{CPI}_1-\widehat{CPI}_2}{\widehat{PPI}_1-\widehat{PPI}_2}$	0.8684	0.8707	0.8710	0.8699	0.8708	0.8762	1.08
Ext. M.(%)[40]	23.1812	23.8325	23.9000	23.6246	24.2024	24.5370	25
Int. M.(%)	13.1029	13.6489	13.9233	13.7095	14.4532	12.9649	16.5
M. H. Index	$1,583$	$1,583$	$1,585$	$1,582$	$1,583$	$1,533$	*n.a.*

4.4 Conclusions

The fourth chapter of my thesis studies one of the major issues in international economics, that is the Purchasing Power Parity puzzle, that consists in a weak connection between exchange rates and national price levels. One of the common explanations to this issue is often given by pricing-to-market. Indeed, there is a lot of evidence about the fact that the same goods can be priced differently according to the (national) markets in which they are sold. Thus, the first aim that I pursue is to evaluate the effect of cross-country preference heterogeneity on differences of prices across different national markets for the same goods. Preference heterogeneity might be explained by many different factors, of both cultural and environmental type (think, for example, of how hard selling Italian coffee in the Indian market or air conditioners in the Arctic areas is). Different tastes across countries could lead to different distributions of country level total expenditure of households over the same panel of goods. Thus, such a heterogeneity could affect international trade both in terms of quantities and in terms of prices. This is because tastes can contribute to determine the country specific size of the market for each good and, in turn, the market size can

[39] Ho.P.=Homogeneous preferences. Preferences are equal both across sectors and across countries. Differently from the previous case, the fixed costs of production are set as larger than zero.

[40] Abbreviations are explained in the previous footnote.

affect the degree of competition and prices charged by competitors. Furthermore, cross-country asymmetry in tastes is also studied in combination with fixed costs of production and economies of scale, so as to capture the home bias effect. In more detail, I test the hypothesis that, in order to exploit increasing returns to scale, national economies tend to produce more those goods that domestic consumers seem to like more than other goods.

In order to address the aims stated above, I extend the very rich framework set up by Atkeson and Burstein (*AER*, 2008), by introducing cross-country heterogeneity in demand preferences and fixed costs of production. The original model studied large and systematic deviations from the relative purchasing power parity (i.e. the hypothesis according to which the relative price of a trade good should stay constant over time), that had been found in actual data related to several countries. The explanation that the authors gave to the issue mainly relied on pricing-to-market, that is the choice of individual producers to change the relative price of her output abroad and at home as a response to aggregate international shocks. More specifically, their model featured two important characteristics: imperfect competition with variable markups and international trade costs (both fixed and "iceberg" costs.) In terms of results, their model resulted to be able to match many relevant values of international trade and market structure and, particularly, to almost reproduce actual deviations from the relative purchasing power parity in the US economy. So, I chose to start from that setting as I thought that their work could be further improved. In fact, actual data give evidence of pricing-to-market as CPI-based real exchange rate result to be almost as volatile as PPI-based real exchange rate in many countries (if PPP held,instead, then the movements of the two types of real exchange rates should be almost no related at all.) Nevertheless, according to AB (2008), fluctuations of CPI-based real exchange rate after aggregate productivity shocks are as large as only slightly more than 80 percent of the fluctuations of PPI-based exchange rate. Thus, there is a remaining 20 percent of the actual relationship between the two movements that still needs to be explained.

The first step of my work was to find a plausible proxy to country level demand preferences. Within this scope, I chose CPI weights provided by the OECD database, that represent the shares of household final consumption on 58 products classified according to the four-digit C.O.I.C.O.P. (i.e. Classification of Individual Consumption According to Purpose). So, I collected CPI weights data for the US and for five of the top US international trading partners (Canada, Germany, Japan, Mexico and the UK). Then, for each country, I aggregated the weights according to seven broad categories: Food, Housing, Apparel, Transport and Communication, Medical Care, Education and Recreation, Other Goods. This was to allow to more easily compare CPI weights distributions across the six countries considered. More specifically, it turned out that the US have the largest share of total household expenditure spent for Housing and Medical Care and a lowest share spent for Food and Education and Recreation (in the latter, it precedes only Mexico). Moreover,

among the US trading partners, Mexico and, in a second position, Japan resulted to be among the farthest ones from the US in terms of expenditure shares on Food and Housing, that in most of the cases represent more than half of the total expenditure. Overall, the most homogeneous country with the US in terms of CPI weights distribution seems to be Canada; among the European countries, instead, Germany looks to be relatively closer with respect to the UK. In addition, I also tried to empirically show the presence of home bias in the US and in some of the top US trading partners. Even in this case I exploited the OECD database, where I found data, at the 2-digit industry level (ISIC, Rev. 3) on consumption, production (from the Input-Output tables) and on the number of enterprises (from SSIS, i.e. Structural Statistics of Industry and Services). Thus, I graphically gave some evidence that in the US, such as in the UK and, to a lesser extent, in Germany, in different years, consumption and production patterns across different industries are very close. This means that, within those economies, the larger the consumption of a certain good, the larger the production of that good and, particularly, the larger the number of firms producing that good. Thus, it came out that consumer preferences are also linked to the number of firms able enter and produce within each industry.

Next, I tested the two extensions of AB (2008) introduced. In the numerical exercises, all the parameters that are common to the original setting are set at the same values. The target is to measure changes in international relative prices after a negative shock to aggregate productivity in one of the two countries. Thus, according to the first (simpler) extension, the only difference with the original framework is the heterogeneity in demand preferences. More specifically, preferences in country 1 are always proxied with US CPI weights in 2000, while preferences in country 2 are proxied with CPI weights of some of the top US trading partners: Canada, Germany, Japan, Mexico and the UK. It resulted that introducing preference heterogeneity both across sectors and across countries does not improve the ability of the model to predict the actual volatility of CPI-based RER with respect to the volatility of PPI-based RER. In more detail, proxying preferences in country 2 with preferences of countries more similar to the US (such as Canada) made almost no difference with respect to proxying them with preferences of more different countries (such as Mexico and Japan). If cross-country preference heterogeneity did not give relevant results, cross-sector preference heterogeneity turned out to matter more, especially in terms of both extensive and intensive margins. It came out that exporting to countries where preferences are more concentrated in some sectors with respect to the others (such as Canada) is harder than exporting to those countries where preferences are more equally distributed across different goods (such as the UK). Intuitively, one the one hand, if consumption is more concentrated in some sectors, the other ones will be so thin that exporters will have to struggle to sell goods belonging to them. On the other hand, sectors associated to very large preferences are not able to offset the previous effect by

allowing a relatively larger number of exporters to access the market.

Turning to the more complicated extension, that includes both preference heterogeneity and fixed costs of production into the original model, this led to an improvement in terms of prediction of the actual ratio of changes in CPI-based RER to changes in PPI-based RER. Moreover, the extensive margin predicted by this version turned out to be not so different from the actual data. This was because production fixed costs do not impose a reduction of the only number of exporters, but of the number of all producers that now have to face selection at the entry. On the other side, the degree of concentration across sectors resulted to be a little higher according to the new model as the total number of competitors within the two economies falls: however, the value of the median Herfindahl index does not become too different from the value reported in AB (2008). Even in this case, adding preference heterogeneity across countries did not yield any benefit in terms of prediction of the target variable. As before, among the heterogeneous preference cases tested, the lowest ratio of exporters to total domestic producers results (and the lowest intensive margin) were given by the case in which preferences are less equally distributed across categories (i.e. US trading partner's preferences are proxied by Canada's CPI weights). In addition, the lowest extensive margin is also associated to the lowest prediction of the volatility of CPI-based RER with respect to the volatility of PPI-based RER. This could be explained by the fact the lower the number of exporters in the economy, the lower the impact of pricing-to-market on the aggregate economy, as long as firms selling only in the domestic market can not charge different prices across different (national) markets. On the other side, the largest the extensive margin, the largest the intensive margin and one of the largest predicted values of the target variable resulted in the case in which US trade partner's preferences are proxied by the UK that, differently from Canada, report a lower value of standard deviation across CPI weights.

In conclusion, it might be worth mentioning the results from one further test I implemented, that consisted in allowing for cross-country heterogeneity in fixed costs of production, that is $F_{p_1} \neq F_{p_2}$. In fact, it would not be hard to believe that fixed costs of production vary across countries. However, the test did not give important improvements with respect to the homogeneous fixed costs of production case.

5 The Role of Trade Costs Asymmetry in Explaining Pricing-to-Market

5.1 Introduction

The fifth chapter of my thesis tries to address the same issue as in the previous chapter, i.e. the Purchasing Power Parity puzzle, following a different approach. In this case, I focus on the role of trade costs and, particularly, of the possible cross-country heterogeneity in those costs in explaining the extent of pricing-to-market. In fact, even though a part of those costs (mainly related to physical distance) could be thought of as not strongly depending on the direction of the shipping, there is another part that may vary according to the direction itself, as country specific. Therefore, shipping a pair of shoes from Europe to the US might lead to a different trade cost with respect to shipping that pair of shoes from the US to Europe. This is because US exporters to Europe might have to deal with costs related to, for example, wholesale and retail costs, marketing, advertising costs and local transport, that are different in extent from the costs that European exporters have to face when they ship their goods into the US market.

Anderson and van Wincoop (2004) estimated the tax equivalent of "representative" trade costs (for industrialized countries) to be equal to around 170 percent. Those costs included transportation costs (of both freight and time type), border related trade barriers (i.e. tariff and nontariff barriers, language barrier, different currency, information and security costs) and retail and wholesale distribution costs. They documented the fact that some of them can vary across different goods and different countries. An important case might be given by nontariff barriers, that are measures aimed at, in a broad definition, price, quantity and quality control as long as at antidumping control. According to the TRAINS (TRade Analysis and INformation System) data, the US have 27.2 percent of tariff lines subject to nontariff trade barriers, while, for example, Argentina they are equal to 71.8 percent, in Canada to 30.7 percent and in Mexico to 58.0 percent. Another relevant case is given by transport costs, that can be of direct type, such as freight charges and insurance, or of indirect type, such as holding cost for the goods in transit, inventory cost due to buffering the variability of delivery dates and preparation costs related to the size of shipment. The all commodities arithmetic average range from 7.3 percent of the free on board price in Uruguay to 17.5 percent in Brazil (it is equal to 10.7 percent in the US). Distribution costs also result to be varying across countries: they range from 42 percent of producer prices in Belgium to 70 percent in Japan (in the US they are equal to 68 percent).

Indeed, such a heterogeneity could generate asymmetries in terms of international trade volumes and prices. In particular, if these costs affect the degree of competition within the

national economies by imposing entry barriers to exporters, then the heterogeneity in those costs could also imply different pricing across countries. Thus, on the one hand, countries that impose lower trade costs to foreign competitors should have more competition within the domestic market and, then, lower prices. On the other hand, countries that impose larger barriers to competitors coming from abroad, might have less competition in the market and then larger prices. So, even at the firm level, it could result that the price charged in the domestic market differ from the price charged abroad as a consequence of, *ceteris paribus*, a different degree of competition in the two markets due to trade costs heterogeneity.

Therefore, in this chapter, I aim at testing whether such an asymmetry in trade costs can give a contribute to understand why firms seem to price-to-market and, in turn, why the purchasing power parity does not seem to hold. I am first going to provide some actual data that give some evidence about such an asymmetry in reality and, then, I am starting from same framework as before, that is AB (2008), to build up a model that takes into account both variable markups and (heterogeneous) international trade costs.

A short review of the literature about international trade costs is following. Samuelson (1954) studied the effects of different types of trade impediments within a simple two-country two-good model. In particular, the first type of impediment was given by real transport costs, there were defined in a way that will become famous in the modern literature on international trade. The starting idea was that part of the good shipped abroad is consumed in the act of shipments. Thus, these trade limits were defined as "real" as they implied the use of resources in shipping goods. As an example to describe such costs, Samuelson used ice: only a part of the ice exported to another country will arrive at destination, while the other part will be melted away. Limao and Venable (2002) pointed out that traded costs depend on infrastructure, by which they meant the average of the density of the road network, the covered road network, the rail network and the amount of telephone lines per person. Thus, infrastructure variable turned out to also affect trade volume. Anderson and van Wincoop (2003) set up gravity model featuring multiple regions and multiple differentiated goods. Each region was assumed to be specialized in the production of one good and the total supply of each good was assumed to be fixed. In this model, prices were allowed to differ across destinations because of trade costs, that arose from the exporter side. More specifically, trade costs were thought of as information costs, legal and regulatory costs and transport costs. Thus, bilateral trade was determined by relative trade barriers, that are the bilateral trade barriers relative to the average trade barriers that each of the two regions have to face with all trading partners. Burstein, Neves and Rebelo (2003) showed a really large extent of distribution costs for the average consumer good: it amounted to around 40 percent of the retail price in the US and 60 percent of the retail price in Argentina. According to their model, no good is traded

for free. This is because all goods need distribution services (such as wholesale and retail services, marketing and advertisement and local transportation services) that are intensive in local labour and land, so that they can not be traded. So, because such distribution services are non-tradable and country specific, then they contribute to generate price differentials for traded goods across countries. Anderson and van Wincoop (2004) surveyed different measures of trade costs, that are defined as costs faced to ship a good to the final consumer. Some examples of trade costs made follow: transportation costs (concerning both freight and time), policy barriers (of both tariff and non-tariff types), cost of switching from one currency to another one, information costs, security costs, contracts enforcement costs, legal costs and wholesale and retail distribution costs. They turned out to be really large, especially in the industrialized countries. Moreover, they were also shown to be very variable across both goods and countries. Corsetti and Dedola (2005) set up a two-country model of real and monetary transmission in case of international price discrimination. According to this framework, upstream monopolistic firms sell tradable goods to competitive retailers that are located in different places. Such vertical interaction between monopolistic producers and local retailers, that leads to market segmentation, is exploited to study the implications of distributive trade on the level of exchange rate pass-through into import prices. Particularly, the elasticity of demand for the same good turned out to differ across national markets due to the fact that distribution services are intensive in local nontraded inputs. Arkolakis (2008) aimed at shedding light on market penetration costs that are mainly thought of as marketing costs. The larger the population size of a market, the lower the cost of selling goods to a given number of consumers within that market (some evidence is provided about how cost of advertising varies by population size). Furthermore, the larger the number of consumer reached, the larger marginal cost of marketing, meaning that a firm entering the market is going to deal with increasing marginal costs in order to reach additional consumers (evidence on decreasing returns to scale of advertising costs was also reported). Finally, Helpman, Melitz and Rubistein (2008) set up a model able to catch two important features of international trade: first, zero trade flows between many pairs of countries; second, the varying number of exporting firms across destination countries. Then, trade barriers resulted to be able to affect trade through two channels: the intensive margin, that is the trade volume for each exporter, and the extensive margin, that is the number of exporters. In more detail, producers willing to export were assumed to deal with two additional costs, that were a transport cost and a fixed cost of exporting to a specific country. Thus, those additional costs were not assumed to depend on the identity of exporting producers but on the identity of origin and destination countries.

I extend the Atkeson and Burstein (2008) framework by introducing heterogeneous international trade costs. More specifically, my model keeps some crucial features that are

already in the original framework, such as imperfect competition with variable markups and international trade costs. However, with respect to that setting, I add asymmetry in iceberg costs: exporters' marginal costs are scaled up by factors that can vary across countries. The main target I am pursuing is to possibly improve the ability of the original framework in showing that CPI-based real exchange rates are as volatile as PPI-based real exchange rates, without worsening the other important results. In fact, if actual data were saying that relative consumer prices moved almost one-by-one with relative producer prices, that model I am referring to was able to address only slightly more than 80 percent of that relationship. Just as a quick reminder, they started from two empirical facts concerning the US economy: first, the manufacturing terms of trade are much less volatile then the PPI-based real exchange rate; second, CPI-based real exchange rates move roughly one-by-one with manufacturing PPI-based real exchange rates. That evidence at the aggregate level was suggesting that relative PPP (Purchasing Power Parity, that is the hypothesis according to which the relative price of a good traded between two countries is supposed to be constant over time) was not holding at the aggregate level, because of pricing-to-market. The link between PPI-based real exchange rate and the terms of trade is explained by the following formula:

$$\widehat{\frac{PPI}{PPI^*}} = \widehat{\frac{EPI}{IPI}} + \widehat{\frac{PPI}{EPI}} + \widehat{\frac{IPI}{PPI^*}}, \tag{54}$$

where PPI/PPI^* is the PPI-based real exchange rate, EPI/IPI is the terms of trade, PPI/EPI is the ratio of domestic producer and export prices and, finally, IPI/PPI^* is the ratio of import (that is, foreign country export) and foreign producer prices. Notice that hats indicate changes in the logarithm of the variables; furthermore, nominal exchange rates are not used in order to express international price ratios as prices are assumed to be measured in a common currency. If case of relative PPP holding, the last two terms of (54) are zero; nevertheless, Atkeson and Burstein provided evidence that they are actually larger than zero at the aggregate level and that was the first signal that, in fact, PPP did not hold. On the other side, one further signal of not holding relative PPP was that international trade was not able to reduce the impact of movements in relative producer prices on relative consumer prices for tradable goods. In terms of formula, I can express the relationships between consumer price and producer price in both the domestic country (say country 1) and the foreign country (say country 2) as follows:

$$\begin{aligned}
\widehat{CPI}_1 &\simeq \widehat{PPI}_1 + s_1\left(\widehat{IPI}_1 - \widehat{EPI}_1\right), \\
\widehat{CPI}_2 &\simeq \widehat{PPI}_2 + s_2\left(\widehat{EPI}_1 - \widehat{IPI}_1\right).
\end{aligned}$$

In more detail, s_1 and s_2 are the shares of consumption expenditure on imports in, re-

spectively, country 1 and country 2. In particular, due to preference asymmetry across countries, it can be

$$s_1 \neq s_2,$$

so that shares of consumption expenditure on imports might be different. Nevertheless, such an asymmetry does not necessarily imply trade unbalance between the two countries as long as countries can be asymmetric in size. Thus, the ratio of the change in the CPI-based RER (real exchange rate) and the change in the PPI-based RER is given by

$$\frac{\widehat{CPI}_1 - \widehat{CPI}_2}{\widehat{PPI}_1 - \widehat{PPI}_2} = 1 - (s_1 + s_2) \frac{\widehat{EPI}_1 - \widehat{IPI}_1}{\widehat{PPI}_1 - \widehat{PPI}_2}. \tag{55}$$

Of course, as in Atkeson and Burstein (2008), the latter expression highlights that the larger deviations from the relative PPP, the more relative consumer prices and relative producer prices move together. If PPP holds, then the second term of the right side of (55) is very close to 1, so that fluctuations in relative consumer prices as a share of fluctuations in relative producer prices almost amount to 0.

5.1.1 Cross-country heterogeneity in trade costs

In order to show that at least part of international trade costs can vary across countries, I will next report some data that I have drawn from the World Bank database. The first variable I consider is the cost to export. That latter measures the fees imposed on a 20-foot container in US dollars. Particularly, the fees considered are those related to completing the procedure to export to a particular country, such as documents, administrative fees for customs clearance and technical control, terminal handling charges, customs broker fees and inland transport.[41] The second variable I take into account is the lead time to export, that is recorded in calendar days. The time is calculated from the moment the procedure is initiated to the moment it is completed. Moreover, the fastest legal procedure is considered in case there are alternative faster procedures that require additional costs. The procedures are assumed to be completed without delays. In case more procedures can be completed in parallel, they are measure simultaneously. Finally, the measure also includes the waiting time between different procedures.

The World Bank provides the values of these variables from 2005 to 2009. I choose to take the average value across those years for the US and the US top ten international trading partners (that represent 65.78 percent of the total volume of US international trade), that are Canada, Mexico, Japan, China, Germany, the UK, South Korea, France

[41] The World Bank futher specifies that tariffs or trade taxes are not included and that only official costs are recorded.

and Italy (sorted by trade volumes in 2001, according to the Bureau of Transportation Statistics of the US Department of Transportation).[42]The values calculated are reported in Table 5.1 below. It results that costs to export to the US (984 $) are lower than costs to export to Canada (1348 $), Mexico (1370 $), Japan (989 $), France (1019.6 $) and Italy (1222.6 $) that, together, represent 47.08 percent to total US international trade volume. In more detail, costs to trade to the US turn out to be, respectively, 27 and 28.17 percent lower than costs to export to Canada and Mexico, that are the top two US trading partners. Furthermore, in terms of lead time to export, exporting goods to US consumers takes less time than exporting goods to consumers from all the US top trading partners. More specifically, exporting to the US takes, on average 5 calendar days, that is less than half of the time needed to exporting procedures to Canada (11.2 days), Japan (11 days) and France (13.8 days) and less than one third of the time required to complete the procedure of exporting in Mexico (17 days) and Italy (18 days). The gap becomes even larger when the US are compared to China, where lead time to export is equal, on average, to 24 days. Therefore, it seems that exporting procedure to the US are less costly in terms of both fees and time than exporting procedures to those US trading partners that represent a very large share of the total US international trade volume.

Table 5.1

Export Costs Heterogeneity

Country	*Cost to Export (average 2005-2009)*	*Lead Time to Export (average 2005-2009)*
US	984	5
US trading partners		
Canada	1348	11.2
Mexico	1370	17
Japan	989	11
China	415	24
Germany	782.8	7
UK	923.2	8.6
South Korea	762.8	10
France	1019.6	13.8
Italy	1222.6	18

Source: World Bank database

[42]Export costs data for Taiwan, that is ranked at the 8th position among the top 10 U.S. trade partners, are not available in the World Bank database. So, I excluded Taiwan even when I calculated the share of total U.S. volume represented by the top U.S. trade partners.

5.2 The model

The model I set up is a direct extension of Atkeson and Burstein (2008) framework. The latter is a two-country model where each country (indexed by $i = 1, 2$) produces a large amount of differentiated goods. Trade between those two countries is limited by two types of trade costs: fixed costs and iceberg costs. Furthermore, the driving force of international price fluctuations is given by aggregate shocks to productivity.

Preferences in country i are assumed to have the following from:

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_{it}, 1 - l_{it}\right),$$

where β is the discount factor and $u\left(c_{it}, 1 - l_{it}\right) = \log\left[c^{\mu}\left(1 - l_{it}\right)^{1-\mu}\right]$. In particular, c_{it} indicates final consumption and l_{it} indicates the working hours of the representative household in country i at time t. In particular, c_{it} indicates final consumption and l_{it} indicates the working hours of the representative household in country i at time t. In the maximization problem, the consumet budger constraint is:

$$P_{it}c_{it} + b_{it+1} = W_{it}l_{it} + (1 + r)b_{it},$$

where the expenditure side of the constraint is given by the sum of purchase of the final consumption good and purchase of one-period-forward bonds while the income side is given by the the sum of labour income and income from maturing bonds purchased at time $t-1$. Moreover, in each country households are assumed to trade a complete set of international assets. Households, utility maximization problem yields the following standard first order conditions:

$$\frac{1-\mu}{\mu}\frac{c_{it}}{1-l_{it}} = \frac{W_{it}}{P_{it}} \quad for \quad i = 1, 2, \tag{56}$$

$$\frac{c_{2t}}{c_{1t}} = \frac{P_{1t}}{P_{2t}}, \tag{57}$$

where W_{it} and P_{it} indicate, respectively, the wage and the final consumption price in country i at time t. Thus, 56 and 57 are used in solving for equilibria and they hold for every t and for every state of nature. Finally, the intertemporal first-order condition for the dynamic choice problem is explained by the following Euler condition:

$$\beta\frac{P_{it}}{P_{it+1}}\left(1 + r\right)u_c'\left(c_{it+1}, 1 - l_{it+1}\right) = u_c'\left(c_{it}, 1 - l_{it}\right).$$

Aggregation of Goods into Sectors

As the model targets the study of the behaviour of international relative prices at

both an aggregate and a disaggregate level, it features more levels of aggregation of goods. Individual firms produce goods, that are commodities representing physical objects, which can be traded across coutries. Moreover, firms sell their outputs to specific sectors. The latter are the first level of aggregation used in the model and represent the lowest level of disaggregation of commodities employed for the construction of price indeces. In more detail, in each of those sectors there are only a small number of firms: this means that the price charged by each firm is affected by the prices charged by all the other firms within the same specific sector. Finally, sectors are aggregated into a final composite consumption good. Next, I describe the aggregation of differentiated goods into sectors and the aggregation of sectors into final consumption at time t (the suscript t will be dropped for simplicity.) So, final consumption, c_i, is obtained by aggregating the large number of sector level intermediate aggregates, y_{ij}, for $j \in [1, S]$ according to a standard CES function

$$c_i = \sum_{j=1}^{S} \left[y_{ij}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}. \tag{58}$$

The aggregate price P_i for final consumption is equal to

$$P_i = \left[\sum_{j=1}^{J} p_{ij}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \tag{59}$$

and the inverse demand for the output of individual tradable sectors is given by

$$\frac{P_{ij}}{P_i} = \left(\frac{y_{ij}}{c_i} \right)^{-\frac{1}{\eta}}. \tag{60}$$

So, turning to the lower level of aggregation, in each country i and sector j there may be, in equilibrium, up to K domestic firms selling differentiated goods and up to K foreign firms selling their output to the same sector. In terms of notation, firms $k = 1, 2, ..., K$ are indicated as domestic, while firms $k = K+1, K+2, ..., 2K$ as foreign. Assuming that there are no international trade barriers and fixed production costs either, so that all the firms, both domestic and foreign, are able to sell in each sector, sector level aggregate consumption is given by

$$y_{ij} = \sum_{k=1}^{2K} \left(q_{ijk}^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}, \tag{61}$$

where q_{ijk} indicates the sales of firm k in sector j and country i. Goods within the same sector are assumed to be more substitutable than goods across different sectors, that is $1 < \eta < \rho$. Note that imperfect substitution between goods within the same sector implies that each firm within that sector charges a distinct price although firms are involved in quantity competition. As standard, the aggregate price at the sector level is equal to

$$P_{ij} = \left[\sum_{k=1}^{2K} \left(P_{ijk} \right)^{1-\rho} \right]^{\frac{1}{1-\rho}}, \tag{62}$$

and the inverse demand for differentiated goods within a given sector is equal to

$$\frac{P_{ijk}}{P_{ij}} = \left(\frac{q_{ijk}}{y_{ij}} \right)^{-\frac{1}{\rho}}. \tag{63}$$

Production

Firms produce according to a constant returns to scale function employing labour as the only input. In particular, the production function of a firm takes on the following form:

$$q_{ijk} = A_i z_{jk} l_{ijk}, \tag{64}$$

where l_{ijk} is the labour amount employed at the firm level, A_i is the aggregate productivity in country i, that is common to all firms producing in that country, and z_{jk} is the firm level productivity. Each firm within sector j and country i draws its idiosyncratic productivity z_{jk} from a log-normal distribution, that is $\log z_{jk} \sim N(0, \theta_j)$. More specifically, firm level productivity is assumed to constant over time, while the aggregate productivity, A_i is allowed to change after shocks to the aggregate national economy i .

A firm with productivity z_{jk} selling to the domestic market i, within sector j, will cope with the following marginal costs:

$$mc_{ijk}^{D} = \frac{W_i}{A_i z_{jk}}. \tag{65}$$

Instead, firms willing to sell abroad have to cope with not only (marginal) production costs but also with international trade costs. The latter are assumed to be of two different types. First, every firm wishing to export any amount of its output to the other country has to pay a fixed labour costs, F_x. Second, exporting firms' marginal costs will be scaled up by an iceberg type costs, $D_l \geqslant 1$, where $l \neq i$. Crucially, differently from the cases presented in chapter 4, iceberg costs can differ across countries, so that it can be that $D_1 \neq D_2$. Therefore, the marginal costs faced by a firm placed in country 1, sector j, and with productivity z_{jk} wishing to sell part of its output to country 2 is equal to

$$mc_{1jk}^{F} = \frac{D_2 W_1}{A_1 z_{jk}}. \tag{66}$$

Indeed, if $D_l = 1$, then the marginal costs faced by firms placed in country i to sell both at home and abroad are equal. Notice that trade cost, both of iceberg type and fixed type, are constant over time and must be dealt with every time a firm wishes to

export anything. Finally, the total number of firms selling to each sector is determined endogenously in equilibrium. I assume that all the firms sell in the respective domestic country, as they do not have to deal with fixed costs of production, so that the minimum number of competitors within each sector is equal to K. Nevertheless, among the further K potential sellers from abroad, it can happen that not all of them are able to cover the fixed costs of export and then make nonnegative profits by exporting. Thus, the total number of firms within one sector can be lower than $2K$ in equilibrium.

Profit maximization and price setting

Firms producing individual goods are engaged in imperfect competition. More specifically, firms play a static game of quantity competition. Each of them chooses the quantity q_{ijk} to sell in country i taking as given the quantities chosen by all the other firms in the economy, along with the respective domestic wage rate W_i , the final consumption quantity c_i and the aggregate price P_i. Indeed, firms are assumed to be aware that their choice about q_{ijk} affects the sectoral aggregate price P_{ij} and the sectoral aggregate production y_{ij}.

Domestic firms

I first solve for equilibrium prices and quantities for the domestic firms. I assume that in each sector there are only K domestic firms producing and selling. As an example, l take sector j in country 1: the vector of prices P_{1jk} and quantities q_{1jk} for firms $k = 1, 2..., K$, are equilibrium prices and quantities in sector j if, for each firm in that sector, the quantity q_{1jk} and the price P_{1jk} result to be the solutions to the following maximization problem :

$$\max_{p_{1jk}, q_{1jk}} p_{1jk} q_{1jk} - q_{1jk} \frac{W_1}{A_1 z_{jk}}, \tag{67}$$

subject to the following inverse demand function derived from (60) and (63):

$$\frac{P_{1jk}}{P_i} = \left(\frac{q_{1jk}}{y_{1j}}\right)^{-\frac{1}{\rho}} \left(\frac{y_{1j}}{c_1}\right)^{-\frac{1}{\eta}}, \tag{68}$$

where y_{1j} is given by (61). Notice that, in the maximization problem, aggregate price, P_1, final consumption, c_1, and the quantities produced by the other competitors in sector j, q_{1lk}, with $l \neq k$, are taken as given.

Thus, in sector j, equilibrium prices are found by solving a system of K nonlinear equations, that are given by the first-order conditions of the profit maximization problem:

$$P_{1jk} = \frac{\varepsilon(s_{1jk})}{\varepsilon(s_{1jk}) - 1} \frac{W_1}{A_1 z_{jk}}, \tag{69}$$

where

$$\varepsilon(s_{1jk}) = \left[\frac{1}{\rho}(1 - s_{1jk}) + \frac{1}{\eta} s_{1jk}\right]^{-1}, \tag{70}$$

and s_{1jk} is the market share of firm k within sector j (country 1), that is

$$s_{1jk} = \frac{P_{1jk}q_{1jk}}{\sum_{l=1}^{K} P_{1jl}q_{1jl}}.$$

From (63) and (62), I can express the market share as a function of prices:

$$s_{1jk} = \frac{(P_{1jk})^{1-\rho}}{\sum_{l=1}^{K} (P_{1jl})^{1-\rho}}. \tag{71}$$

In solving the system of equations, W_1, A_1 and the firm level productivities, z_{jk} are taken as given. Needless to say, the procedure described above to find equilibrium prices in sector j in country 1 is the same for all the sectors in both the countries, 1 and 2.

Adding foreign firms

The number of foreign competitors within each sector is determined according to a dynamic multistage game solved by backward induction, with firms deciding in each period whether and how much to export. As previously said, differently from domestic competitors, foreign sellers have to deal with iceberg marginal costs and fixed costs of export: this means that they enter the foreign market only if they can cover the fixed costs of export and make nonnegative profits. The levels of wages in the two countries, W_i, final consumption, c_i, and aggregate price, P_i are taken as given during the procedure; they are determined in general equilibrium. Foreigners are assumed to be ordered according to a reverse order of unit costs, that is from the most productive to the least productive. As I did before, I use sector j in country 1 to illustrate the procedure. Each entrant $K+n$, with $n \in [1, K]$, plays a simultaneous-move game of quantity competition. Equilibrium prices are calculated through a system of $K+n$ nonlinear equations: in more detail, the first K equations are related to the domestic firms (69), while the following n equations are related to the prices that the first n entrants in sector j from country 2 charges to country 1 consumer. For example, the price charged by the nth entrant is equal to

$$P_{1jK+n} = \frac{\varepsilon\left(s_{1jK+n}\right)}{\varepsilon\left(s_{1jK+n}\right) - 1} \frac{D_1 W_2}{A_2 z_{jK+n}}.$$

Once I have calculated the equilibrium prices, I can calculate the sectoral price (62); then, I can derive the amount exported by firm $K+n$, by using (60), (63) and $P_1 c_1^{\eta}$ (the latter is used to calculate the sectoral output.) Then, I can calculate the profit earned by the nth entrant: if it does not cover the fixed cost of export, $W_2 F_x$, then in equilibrium there will be $K+n-1$ competitors in sector j of country 1. Therefore, this procedure, repeated for both the countries, sector by sector, yields the final number of competitors in each sector (including exporters) and a set of equilibrium prices P_{ijk} given fixed wages, aggregate prices and quantities (that are calculated in general equilibrium, as explained next).

General equilibrium

The model is solved statically at every date for the general equilibrium prices and quantities, as a function of the realized productivity shocks at the aggregate level, that are A_1 and A_2. The problem consists of finding a fixed point in the aggregate variables, P_i, c_i, W_i, l_i, with $i = 1, 2$, using W_2 as a numeraire. The solution to this problem is found according the following manner. I first derive the number of competitors and prices in each sector in the two countries taking $P_1^{\eta} c_1$, $P_2^{\eta} c_2$, and W_2 as given. Then, I can calculate aggregate and sectoral prices according to, respectively, (59) and (62); furthermore, I can calculate quantities produced by each firm through (60) and (63). Aggregate labour demand (L_1 and L_2) is derived by summing up the labour demand of all the firms (also considering the fixed costs of export). Thus, the fixed point in the aggregate variables is found when the three first order conditions (56) and (57) result to be satisfied.

5.3 Numerical results

Before fully testing the model I set up, I perform a mapping exercise aiming at two targets. The first one is to quickly verify whether iceberg cost heterogeneity can affect the value of the target variable, the is the ratio of changes in CPI-based RER to changes in PPI-based RER. The second target is to eventually find out those values of trade costs for which it is possible to improve the results of AB (2008).

So, I test the model on a limited number of sectors, i.e. $S = 100$, for different values of $D_1 \in [1.10, 1.15, 1.20, ..., 2.00]$, that is the iceberg type marginal cost that exporters from country 2 to country 1 have to pay. The values of D_2, that is the iceberg type marginal cost that exporters from country 1 to country 2 have to pay, is kept constant at 1.45. Figure 5.1 shows that the value of the target variable changes as D_1 changes. Specifically, keeping D_2 constant, the lower D_1, the larger the volatility of CPI-based RER with respect to PPI-based RER predicted by the model. In addition, Figure 5.2 describes the behaviour of country 1 intensive margin for different values of D_1. This is similar to the behaviour of the target variable shown before, that is the lower the value of D_1, the larger the value of country 1 intensive margin.[43] At the margin, it seems that the effect of changing the iceberg type marginal cost of exporting to country 1, D_1, on the target variable is larger than the effect on the intensive margin. This means that, in terms of calibration, I can easily improve the ability of the model to predict the volatility of CPI-based RER relative to PPI-based RER without affecting so much the most important control variables used: the extensive margin and the intensive margin.

Trying to explain what illustrated in the two graphs, heterogeneity in trade costs implies, *ceteris paribus*, a different selection degree to exporters in the two countries that,

[43] Notive that country 1 extensive margin does not change as country 1 exporters keep facing the same iceberg type marginal costs and fixed costs of exporting.

in turn, leads to a different number of competitors over the aggregate national economies. So, if $D_1 < D_2$, then exporters from country 2 to country 1 face lower marginal costs than exporters from country 1 to country 2. Thus, country 1 will have a larger number of foreign competitors with respect to country 2, as for exporters to country 1 it will be relatively easier to cover the fixed costs of exporting, F_x. Overall, this is going to affect the market shares that each competitor (both domestic and foreign) can hold in the two markets: assuming that the number of domestic competitors is the same in the two markets, due to a larger number of exporters, country 1 is going to have a larger number of competitors that, consequently, will have lower market shares and market power with respect to competitors in country 2. Furthermore, this is going to strengthen the difference in market share that each exporters has in the relative domestic and foreign market. So doing, it can also increase the extent of pricing-to-market predicted by AB (2008). In fact, the latter showed that pricing-to-market occurs when the change in the markup related to export prices is different from the change in the markup related to domestic prices. In more detail, pricing-to-market comes out if the elasticity of markup varies with firm's market share and market shares at home and abroad are different, and (or) if market shares at home and abroad react to shocks to aggregate costs in a different way.

In order to understand the direction of the changes in the target variable as D_1 changes, it is worth to turn to what shown in Figure 5.2. The lower D_1, the larger the intensive margin in country 1: this happens because, even though the extensive margin does not change, i.e. the number of exporters to country 2 is always the same (D_2 is kept constant), the ratio of exports to gross output increases as an effect of an increase in imports, due to lower D_1. So, an increase in trade volume is also associated to a larger extent of pricing-to-market: the larger the export volume, the larger the effect of pricing differentials between the domestic and the foreign market in aggregate.

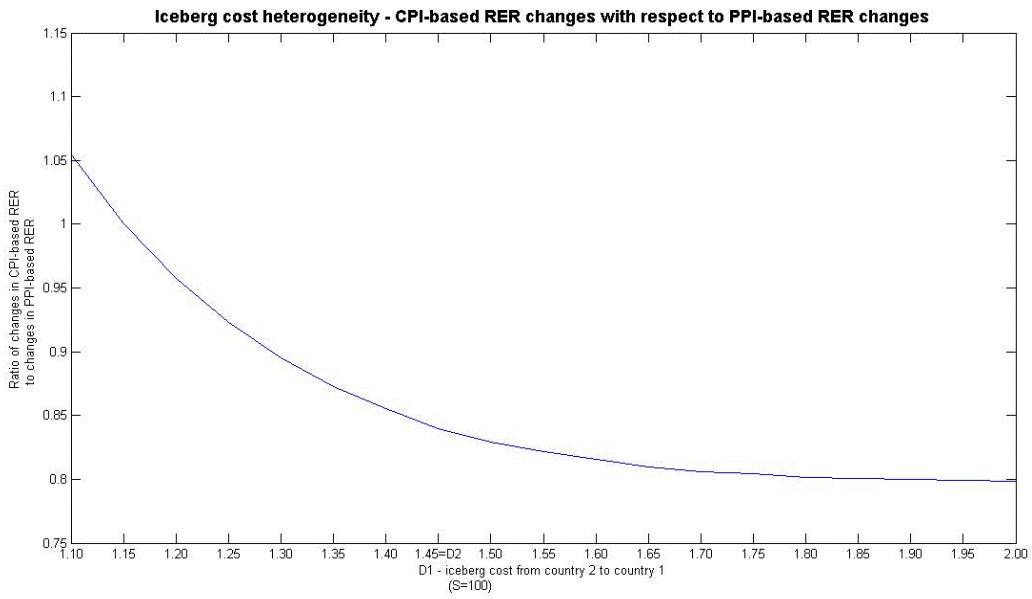


Figure 5.1. Iceberg cost heterogeneity and PTM

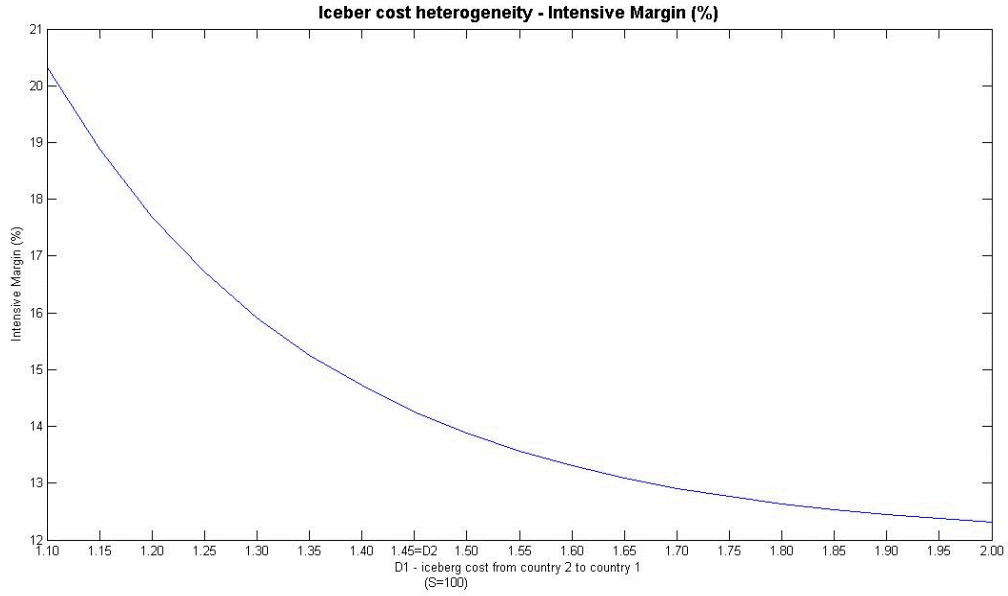


Figure 5.2. Iceberg cost heterogeneity and intensive margin

In Table 5.2 below, I am reporting the results from the numerical exercises that test my extension to AB (2008), that introduces iceberg type marginal cost asymmetry. The test consists in measuring how much international relative prices change in equilibrium after a negative shock to aggregate productivity in country 1, that is A_1, such that aggregate costs in country 1, W_1/A_1, relative to aggregate costs in country 2, W_2/A_2, increase by 1 percent. It results allowing for heterogeneity in iceberg costs in the original setting can lead to an improvement in terms of ability of the model to predict the actual reaction to

aggregate shocks of CPI-based RER relative to the reaction of PPI-based RER. The tests are implemented on 20,000 sectors such as in AB (2008) and all the common parameters (i.e. $K, \theta, \eta, \rho, F_x$) are set at the same values as in the original framework. The only, crucial, novelty with respect to the original setting is given by the heterogeneity in the iceberg type costs: country 1 exporters' marginal costs will be scaled up by 1.45 (i.e. the value of D_2), while country 2 exporters' marginal costs will be scaled up by a lower factor, that is 1.30 (i.e. the value of D_1). Thus, the introduction of heterogeneity in iceberg costs yielded an improvement in terms of ability of the model to predict the actual volatility of CPI-based RER with respect to volatility of PPI-based RER[44] In fact, the value produced by the extended model is equal to 0.8884, that is closer to the actual value, that is 1.08, with respect to the value predicted by AB (2008), that is 0.8379. Furthermore, the new model does not change the predicted value of the extensive margin (24.7877 percent), that then keeps being very close to the actual data (25.00 percent). The intensive margin, for the reasons explained before, turns out to be increased with respect to the benchmark model (14.05 percent): specifically, it is equal to 15.6843 percent. However such a value is far included between the two extreme points of the interval of values from which the actual value is drawn: 11.7 percent and 21 percent. Finally, the measure of concentration across sectors results to be lowered with respect to the benchmark case: this is because, by reducing D_1, more exporters and, then, more competitors will operate in country 1 where, in turn, the median Herfindahl index actually falls (1,350).

Table 5.2. Heterogeneous Vs. Homogeneous Trade Costs

	Heterogeneous iceberg costs	Homogeneous iceberg costs	Actual data
Parameter values			
S	$20,000$	$20,000$	
K	20	20	
θ	0.385	0.385	
η	1.01	1.01	
ρ	10	10	
D_1	1.30	1.45	
D_2	1.45	1.45	
F_x	0.0003	0.0003	
Results			
$\frac{\widehat{CPI}_1 - \widehat{CPI}_2}{\widehat{PPI}_1 - \widehat{PPI}_2}$	0.8884	0.8379	1.08
Ext. Margin (%)	24.7877	24.7877	25.00
Int. Margin (%)	15.6843	14.0500	16.5
M. Herfindahl Index	$1,350$	$1,463$	*n.a.*

[44] In the Appendix, I provide details about how I construct variations to price indeces, i.e. $\widehat{CPI}_1$, $\widehat{CPI}_2$, $\widehat{PPI}_1$, $\widehat{PPI}_2$.

5.4 Conclusions

In this chapter, I studied the role of asymmetry in international trade costs in explaining pricing-to-market and, then, the Purchasing Power Parity puzzle. Even though a part of those costs (the one that is more associated to physical distance) does not strongly depend on the direction of shipping, there is another part that can vary by direction as it is country-specific. So, as an example, shipping a pair of shoes from Europe to the US might lead to a different trade cost with respect to shipping that pair of shoes from the US to Europe. This is because US exporters to Europe might have to deal with costs related to, for example, wholesale and retail costs, marketing, advertising costs and local transport, that are different in extent from the costs that European exporters have to face when they ship their goods into the US market. In the literature, a really important contribute to understand the extent and the variability of trade costs has been given by Anderson and van Wincoop (2004) estimated the tax equivalent of "representative" trade costs to be equal to around 170 percent. Those costs included transportation costs, border related trade barriers and retail and wholesale distribution costs. They documented the fact that some of them can vary across different goods and different countries.

Thus, my starting idea was that such an asymmetry might generate, *ceteris paribus*, asymmetries in terms of international trade volumes and prices. In particular, if these costs affect the degree of competition within national economies by imposing entry barriers to exporters, then the heterogeneity in those costs could also imply, even at the firm level, different pricing across countries.

In order to verify the effectiveness of this idea I have extended Atkeson and Burstein (2008) framework by introducing heterogeneous international trade costs. Quantitatively, the main target was to possibly improve the ability of the original framework, featuring variable markups and (homogeneous) trade costs, to predict the actual extent of pricing-to-market. In fact, according to data the CPI-based real exchange rate is almost as volatile as the PPI-based real exchange rate, while the original setting predicts only slightly more than a 80 percent relationship between the fluctuations of the two rates.

Moreover, aiming at empirically enforcing my theoretical intuition, I provided some data, from the World Bank database, that show that trade costs can vary across countries. More specifically, I consider two variables, that are the cost to export, which measures the fees (in US dollars) imposed on a 20-foot container, and the lead time to export, which is recorded in calendar days. From data, it resulted that cost to export to the US is lower than costs to export to some of the top US trading partners, such as Canada, Mexico, Japan, France and Italy. In addition, exporting goods to US consumers takes less time than exporting goods to consumers from all the US top trading partners: the gap turned out to be really large in case of Mexico, Italy and, especially, China. Turning to the results

from testing the extended model, it came out the introducing iceberg costs heterogeneity can improve the ability of AB (2008) to predict the actual volatility of CPI-based RER with respect to the volatility of PPI-based RER. In particular, all the common parameters were set at the same values as in the original framework. The only, crucial, difference was given by the heterogeneity in the iceberg type costs: country 1 (that represents the US) exporters' marginal costs will be scaled up by 1.45 (i.e. the value of D_2), while country 2 (that represents the US trading partners) exporters' marginal costs will be scaled up by a lower factor, that is 1.30 (i.e. the value of D_1). In terms of explanation of such a finding, the asymmetry in trade costs led to a different number of competitors across the two countries: assuming that the number of domestic competitors is the same, more exporters will enter country 1 as trade costs associated to that market are lower. So, this is going to affect the market shares that each competitor (both domestic and foreign) can hold in the two markets: country 1 is going to have a larger number of competitors that, consequently, will have lower market shares and market power with respect to competitors in country 2. Therefore, heterogeneity in the number of competitors,*ceteris paribus*, strengthens the difference in market share that each exporters has in the relative domestic and foreign market and, then, the extent of pricing-to-market predicted in AB (2008). In fact, the latter proved that pricing-to-market occurs if the elasticity of markup varies with firm's market share and market shares at home and abroad are different, and (or) if market shares at home and abroad react to shocks to aggregate costs in a different way.

Furthermore, the new model does not change the predicted value of the extensive margin, that then keeps being very close to the actual data. The intensive margin, instead, turned out to be increased with respect to the benchmark model, even though it was still not too far from actual data. In fact, as shown in a mapping exercise, the lower D_1, the larger the intensive margin in country 1: this happens because, even though the extensive margin does not change, i.e. the number of exporters to country 2 is always the same (as D_2 is kept constant), the ratio of exports to gross output increases as an effect of an increase in imports, due to lower D_1. Therefore, an increase in trade volume is also related to a larger extent of pricing-to-market: the larger the export volume, the larger the effect of pricing differentials between the domestic and the foreign market in aggregate.

6 Concluding remarks

In this work, I want to shed light on the role of some types of asymmetries within international markets. So, on the one hand, I study allocation efficiency problems related to the integration of input factors across markets that are heterogeneous in the level of internal competition toughness. On the other hand, I evaluate the effect of cross-country heterogeneity in demand preferences and trade costs on firms' choice of pricing-to-market.

So, in the first part of the thesis, I focus on the cross-market markup heterogeneity. I analytically derive the equilibrium in two different economic frameworks, in both of which production is distributed among (many) heterogeneous monopolistic firms aggregated according to a nested CES function. In the first setting, the two production factors in the economy, i.e. labour and capital, are assumed to be free mobile across regional/national markets. In the second one, instead, labour is exogenously restricted at the individual market level, while capital is kept free mobile. Input factors allocation across markets turn out to be crucially different between the two settings. In the integrated model, individual market level allocation of production factors depends not only on the relative productivity but also on the demand elasticity of the market: the larger the productivity and/or the larger the demand elasticity, the larger the allocation of both capital and labour. In the labour constrained framework, instead, labour allocation in each market is given, while capital allocation turns out to be not only a function of both the market specific relative productivity and demand elasticity as before, but also of the amount of labour exogenously allocated. According to the Social Planner, inputs allocation only follows the relative productivity of the individual markets: the larger the relative productivity, the larger the share of production factors held. Both the competitive economies that I derive are able to reproduce that allocation as long as demand elasticities across all the markets are the same. In this case, the integrated model yields a first best solution, while the labour constrained model can match the former if the exogenous allocation of the labour force across the markets is equal to the efficient one. However, none of the competitive economies (i.e. fully integrated and labour restricted) I set up can provide a first best solution if markups are heterogeneous across markets. In that case, full integration leads to an inefficient allocation of both capital and labour: there will be overallocation of inputs in the markets with relatively lower markups and underallocation of them in the markets with relatively larger markups. This is because the larger the markup, the larger the gap between marginal cost and price of the produced good. Thus, if monopolistic powers are heterogeneous, then production resources will tend to be overallocated within those sectors where the demand elasticity is larger, that is where the gap between marginal cost and price is relatively lower. However, I find that the allocation distortion implied by markup asymmetry can be (partially) corrected by an exogeneous restriction of labour force mobility: this solution allows to exogeneously withdraw (part) of the in-

efficiently excessive amount of labour allocated in the relative more competitive market and move that into the relative less competitive market. Nevertheless, this turns out to be not a first best solution. The reason is that capital is still assumed to be free mobile (as it is actually more difficult to think of a restricted capital market) and its allocation keeps being distorted such as in the integrated setting. Moreover, restriction will lead to a solution that is as close to the first best as low the output elasticity of capital: intuitively, the lower the contribute of capital to production, the more effective (exogeneous) labour movements will be in order to get closer to the optimal solution.

In more practical terms, the purpose of my work is to establish an efficient degree of labour force integration across national markets, according to the starting population distribution and the degree of asymmetry in competition level. On the one hand, this would allow to evaluate how effective current agreements on production factors mobility are, especially within the European Union. On the other hand, it would also make possible to contribute to the debate about the economic opportunity of integrating candidate countries with the current EU members. In fact, one of the key targets at the origin of the European Union is to generate and promote a Single Market and, of course, full integration of input factors, namely capital and labour, is crucial to achieve that target. However, my theoretical work shows that, once markets get integrated, free trade of production factors might raise problems as a consequence of asymmetry in markets competitiveness across the countries involved in the agreement. In order to show how plausible and realistic the allocation efficiency problem can be within the European context, I provide some data (from the OECD database) about the extent of market entry barriers related to both current EU member states and some of the EU candidates (Turkey and Iceland). This is because, as argued in Aghion, Harris, Howitt and Vickers (2001), the level of market competition can depend on the level of entry barriers that prevent new competitors from entering the market and competing with the incumbents. Thus, in terms of product market regulations, among the EU-15 countries, there is a big gap between Greece, that reports the largest entry barriers, and Ireland and the UK, that report the lowest entry barriers. Moreover, the members that joined the Union in 2004 seem to have larger barriers than the original members. Among the candidate members, Turkey's barriers exceed the EU-15 ones and can be placed in within the top values across the whole Union; on the other hand, Iceland has got very low barriers. Moreover, from some literature about migration flows across the European Union after the enlargement in 2004, it comes out that the largest migration flows were directed from those countries that report the largest values of entry barriers to those countries that, instead, report the lowest barriers. So, even though I have not estimated an (eventual) inefficiency in the labour force allocation across the larger current European Union, I argue that the problem related to cross-market asymmetry might be plausible. Furthermore, I point out that further enlargements of the Union should also

take into account such possible misallocation problems due to heterogeneity in degree of market competitiveness.

Indeed, the work is expected to be further extended in the future through both a theoretical development of the model and, possibly, an empirical validation of the theoretical predictions. Thus, on the theoretical side, my framework might be developed by making markups endogenous through a free entry mechanism: this means introducing sunk fixed costs in order to make the number of competitors within each industry not given. Keeping firms heterogeneous in terms of technical productivity, one of the scopes of this extension would be to model the relationship between the market specific competition toughness and the productivity distribution across competitors. In more detail, the individual market relative markup would not just depend on the number of competitors as in Epifani and Gancia (2011), but rather on the number of firms that are productive enough to cover fixed costs and enter the market. Therefore, it would be possible to establish a link not only between markup and aggregate productivity but also between markup and productivity distribution. In fact, there might exist markets with a very large aggregate productivity but with only a few very strong competitors that are able to enter the markets, so that those market would result really productive despite of a low internal competition. Furthermore, introducing also a dynamic perspective instead, I might consider firm level productivities coming from the same distribution across all the industries; moreover, I might also assume that the starting number of firms in each industry is the same. Thus, the shock affecting only one firm in only one industry could then change the number of firms within that industry and, if the markup depends on the number of firms, that shock involving only one firm could lead to markup heterogeneity and then to misallocation of input factors. Therefore, this extension would give a more precise picture of competition, particularly at the international level, as it would represent and link with each other very important features of market structure, such as competition toughness and productivity distribution of producers. On the empirical side, I am going to try to find evidence of what my model predicts. In particular, the plan is to measure average price-cost margins and aggregate productivities for the member countries that have joined the European Union so far and, then, to estimate an efficient allocation of both labour force and investments in each of the member countries according to those measures and my model's predictions. Thus, I would be able to compare the results from those estimates with actual allocation of labour and capital across the Union in order to possibly assess whether misallocation problems do actually exist or not. Finally, within this scope, I could exploit the large database provided by Amadeus (Bureau van Dijk), that collects data at the company level on standardized annual accounts, financial ratios, sectoral activities and ownership for 38 European countries, so that it seems to be very useful for this research project.

The second part of my thesis addresses one of the major issues in international eco-

nomics, that is the Purchasing Power Parity puzzle, consisting in a weak connection between exchange rates and national price levels. More specifically, it focuses on pricing-to-market, that is known as one of the most important factors of such a discrepancy. Thus, at the aim of shedding further light about the reasons why firms price their goods differently across national borders, I extend the very rich framework set up by Atkeson and Burstein (*American Economic Review*, 2008). That framework studied the large and systematic deviations from the relative purchasing power parity (i.e. the hypothesis according to which the relative price of a trade good should stay constant over time.), that had been found in actual data related to several countries. The explanation given to the issue mainly relied on pricing-to-market, that is the choice of individual producers to change the relative price of her output abroad and at home as a response to aggregate international shocks. In more detail, their model featured two important characteristics: imperfect competition with variable markups and international trade costs (both fixed and "iceberg" costs.) In terms of results, their model resulted to be able to match many relevant values of international trade and market structure and, particularly, to almost reproduce actual deviations from the relative purchasing power partity in the US economy. So, the target is to improve the reference work in terms of ability to predict the actual value of pricing-to-market. In fact, actual data give evidence of pricing-to-market as CPI-based real exchange rate result to be as volatile as PPI-based real exchange rate in many countries (if PPP held,instead, then the movements of the two types of real exchange rates should be almost no related at all.) Nevertheless, according to the original setting, fluctuations of CPI-based real exchange rate after aggregate productivity shocks are as large as only slightly more than 80 percent of the fluctuations of PPI-based exchange rate. Thus, there is a remaining 20 percent of the actual relationship between the two movements that still needs to be explained. So, I develop two different extensions to that model. The first consists in introducing demand preference heterogeneity and fixed costs of production; the second, instead, consists in allowing for cross-country international trade costs asymmetry.

In order to justify the analytical extensions to the reference model, I provide some data giving some evidence about both cross-country asymmetry in demand preferences (and home bias) and cross-country trade costs heterogeneity. Thus, on the one hand, from the OECD database, I collect CPI weights data, that I use as a proxy to country level demand preferences, for the US and for five of the top US international trading partners (Canada, Germany, Japan, Mexico and the UK). It results that the US have the largest share of total household expenditure spent for Housing and Medical Care and a lowest share spent for Food and Education and Recreation (in the latter, it precedes only Mexico). Moreover, among the US trading partners, Mexico and, in a second position, Japan turn out to be among the farthest ones from the US in terms of expenditure shares on Food and Housing, that in most of the cases represent more than half of the total

expenditure. Overall, the most homogenous country with the US in terms of CPI weights distribution seems to be Canada; among the European countries, instead, Germany looks to be relatively closer with respect to the UK Furthermore, I also show the presence of home bias in the US and in one of the most important US trading partners, that is the UK. In more detail, it comes out that, at the two-digit industry level, consumption and production patterns are very close. This means that, within those economies, the larger the consumption of a certain good, the larger the production and, in addition, the larger the number of firms producing that good. So, consumer preferences are also linked to the number of firms able enter each industry. On the other hand, I give some data, from the World Bank database, that show that trade costs can vary across countries. More specifically, I consider two variables, that are the cost to export, which measures the fees (in US dollars) imposed on a 20-foot container, and the lead time to export, which is recorded in calendar days. So, it comes out that cost to export to the US is lower than costs to export to some of the top US trading partners, such as Canada, Mexico, Japan, France and Italy. In addition, exporting goods to US consumers takes less time than exporting goods to consumers from all the US top trading partners: the gap turns out to be really large in case of Mexico, Italy and, especially, China.

Turning to the numerical results, it results that introducing both cross-country and cross-sector preference heterogeneity does not improve the ability of the model to predict the actual volatility of CPI-based real exchange rate with respect to the volatility of PPI-based real exchange rate. More specifically, preferences in country 1 are always proxied with US CPI weights in 2000, while preferences in country 2 are proxied with CPI weights of some of the top US trading partners: Canada, Germany, Japan, Mexico and the UK Nevertheless, if cross-country preference heterogeneity does not give any relevant result, cross-sector preference heterogeneity turns out to matter more, in terms of both extensive and intensive margins. In more detail, it comes out that exporting to countries where preferences are more concentrated in some sectors is harder than exporting to those countries where preferences are more equally distributed across different goods. Intuitively, if consumption is more concentrated in some sectors, then the other ones will be so thin that exporters will have to struggle to sell goods belonging to them. Nevertheless, sectors associated to very large preferences are not able to offset the previous effect by allowing a relatively larger number of exporters to access the market. However, the more complicated extension, that introduces both preference heterogeneity and fixed costs of production into the original model, leads to an improvement in terms of prediction of the actual extent of pricing-to-market. This result can be considered even stronger if it is taken into account that other important values related to the US economy are actually matched: the ratio of exports to gross output in manufacturing sectors (i.e. intensive margin) and the share of US manufacturing plants that export (i.e. extensive margin.)

Finally, the second extension to Atkeson and Burstein (2008), that introduces cross-country international trade costs heterogeneity, also yields an improvement to the original setting, in terms of ability to predict the actual value of pricing-to-market. In more detail, I consider asymmetry in iceberg costs, by setting that cost in the country representing the US at a lower level with respect to the country representing US trading partners, so as to match actual data about export cost. Trying to explain this result, the asymmetry in trade costs leads to a different number of competitors across the two countries: assuming that the number of domestic competitors is the same, more exporters will enter the country that is associated to relatively lower trade costs. In turn, this is going to affect the market shares that each competitor (both domestic and foreign) can hold in the two markets: the country that imposes lower costs to importers will have a larger number of competitors that, consequently, will have lower market shares and market power with respect to competitors in the other country. Thus,the heterogeneity in the number of competitors,*ceteris paribus*, strengthens the difference in market share that each exporters has in the relative domestic and foreign market and, then, the extent of pricing-to-market. In fact, as argued in the framework I refer to, pricing-to-market occurs if the elasticity of markup varies with firm's market share and market shares at home and abroad are different, and (or) if market shares at home and abroad react to shocks to aggregate costs in a different way. Even in this case, the model does not worsen too much the original setting's predictions of US extensive and intensive margins.

Appendix

A.1 Fully segmented econonomy

Suppose that both capital and labour are segmented at the industrial sector level, i.e. both the input factors are inelastically supplied sector by sector.

Welfare

In an industry s, the welfare function, $I_s^{\#}$ is given by summing up all firms' profits, $\widetilde{\pi}_{n,s}^{\#}$, with n$\in [1, N_s]$, labour and capital incomes:

$$I_s^{\#} = \sum_{n=1}^{N_s} \widetilde{\pi}_{n,s}^{\#} + \widetilde{i}_s^{\#} \overline{K}_s + \widetilde{w}_s^{\#} \overline{L}_s, \tag{72}$$

where $\overline{K}_s$ is the exogenous capital supply in capital s, $\widetilde{i}_s^{\#}$ is the nominal value of the interest rate in sector s, $\overline{L}_s$ is the exogenous labour supply in sector s and $\widetilde{w}_s^{\#}$ is the nominal wage rate in industry s. At the aggregate level, the total welfare is given by adding up all the industry level welfares. Notice that I use the sign # as a superscript to indicate the variables from the fully segmented economy.

Producer optimization

Even in this setting, the monopolistic firms have to hire both physical capital and labour on competitive, respectively, capital and labour markets, because they do not own any input factor. The nominal profit of firm n, s is

$$\widetilde{\pi}_{n,s}^{\#} \equiv \widetilde{p}_{n,s}^{\#} q_{n,s}^{\#} - \left(\widetilde{i}_s^{\#} k_{n,s}^{\#} + \widetilde{w}_s^{\#} l_{n,s}^{\#} \right),$$

where $\widetilde{p}_{n,s}^{\#}$ is the nominal price charged by firm n, s, $k_{n,s}^{\#}$ and $l_{n,s}^{\#}$ are, respectively, the demand of capital and labour from the same firm. Notice that, as both the capital and the labour market are segmented, both nominal rates and nominal wages result to be different across industries.

Thus, firm n, s faces the demand curve such as the one shown before (**??**) and seeks to maximize its profit:

$$\max_{k_{n,s}^{\#}, l_{n,s}^{\#}} \widetilde{p}_{n,s}^{\#} q_{n,s}^{\#} - \left(\widetilde{i}_s^{\#} k_{n,s}^{\#} + \widetilde{w}_s^{\#} l_{n,s}^{\#} \right), \quad \text{subject to } \theta_{n,s} k_{n,s}^{\#\gamma} l_{n,s}^{\#(1-\gamma)} = q_{n,s}^{\#}. \tag{73}$$

Each monopolistically competitive firm faces the minimization problem in (73), in order to derive the minimal unit cost. The result is that each agent within the same industry will choose to operate with the same capital/labour ratio $\kappa_s^{\#}$

$$\frac{k_{n,s}^{\#}}{l_{n,s}^{\#}} = \frac{\gamma}{1-\gamma} \frac{w_s^{\#}}{i_s^{\#}} = \kappa_s^{\#}, \tag{74}$$

The derived demand for labour and capital by firm n, s producing $q_{n,s}^{\#}$ is

$$k_{n,s}^{\#} = \frac{\kappa_s^{\#(1-\gamma)} q_{n,s}^{\#}}{\theta_{n,s}} \quad and \quad l_{n,s}^{\#} = \frac{q_{n,s}^{\#}}{\theta_{n,s} \kappa_s^{\#\gamma}}, \tag{75}$$

As I said before, both capital and labour are exogenously given at the sector level. Thus, in order to make both the labour and the capital markets clear, the following conditions must hold

$$\begin{aligned} \bar{L}_s &= \sum_{n=1}^{N_s} \frac{q_{n,s}^{\#}}{\theta_{n,s} \kappa_s^{\#\gamma}}, \\ \bar{K}_s &= \sum_{n=1}^{N_s} \frac{q_{n,s}^{\#} \kappa_s^{\#(1-\gamma)}}{\theta_{n,s}}. \end{aligned} \tag{76}$$

Optimal prices

As a monopolist, the intermediate input firm n, s seeks to maximize its profit by charging a price $\widetilde{p}_{n,s}^{\#}$ that is equal to a fixed mark-up $(1/\rho_s)$ over cost. Using the optimal capital/labour ratio (74) and the derived demand for capital and labour (75) yields the price charged by firm n, s

$$\widetilde{p}_{n,s}^{\#} = \frac{w_s^{\#}}{(1-\gamma)\, \rho_s \kappa_s^{\#\gamma} \theta_{n,s}} p^{\#}. \tag{77}$$

I set up the following system of equations in order to find the closed solution to the model: the aggregate production function (1), the derived demand of intermediate goods (4), the optimal capital/labour ratio (74), the price functions (77, 4, 3), and the input factors markets clearing conditions (76).

Thus, I find that, within sector s, firm n, s relative price is inversely proportional to firm n, s relative productivity, such as in the competitive economies showed previously in the paper, i.e.

$$\frac{\widetilde{p}_{n,s}^{\#}}{\widetilde{p}_s^{\#}} = \frac{\theta_s}{\theta_{n,s}}. \tag{78}$$

Moreover, I find that:

$$\frac{p_s^{\#}}{p^{\#}} = \frac{\left[\frac{1}{S^{1-\delta}} \sum_{s=1}^{S} \left(\bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma} \theta_s \right)^{\delta} \right]^{\frac{1-\delta}{\delta}}}{\left(\bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma} \theta_s S \right)^{1-\delta}}. \tag{79}$$

Thus, the industry level relative price turns out to be an decreasing function of the labour inelastically supplied in that sector, $\bar{L}_s$, the capital inelastically supplied in that sector, $\overline{K}_s$, and the industry level aggregate productivity, θ_s; indeed, it also results to be scaled up by a function of all the industry level aggregate productivities, and exoge-

nous capital and labour supplies. Particularly, notice that in this case, differently from competitive economies showed before, the demand elasticities are not an argument of this function.

Following, I describe the equations relative to sector level rental and wage rates. On the one hand, in sector s, the equilibrium real interest rate, i_s, differently from the other two competitive economies illustrated before, turns out to be an increasing function of the sector specific demand elasticity, ρ_s, and the sector specific aggregate productivity, θ_s.Of course, the more capital intensive the sector, the lower the equilibrium interest rate. Finally, the real price of capital in equilibrium is also scaled up by a function of all both the capital and the labour supplies over all the sectors, and all the industry level aggregate productivities:

$$i_s^{\#} = \gamma \rho_s \theta_s^{\delta} \frac{\bar{L}_s^{(1-\gamma)\delta}}{\bar{K}_s^{1-\gamma\delta}} \frac{\left[\frac{1}{S^{1-\delta}} \sum_{s=1}^{S} \left(\bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma} \theta_s\right)^{\delta}\right]^{\frac{1-\delta}{\delta}}}{S^{1-\delta}}. \tag{80}$$

On the other side, the equilibrium sector relative wage rate results to be a function of the same parameters as the equilibrium interest rate. Of course, in this case, the equilibrium wage is increasing with respect to the sector specific capital intensity. Particularly, with respect to the labour segmented competitive economy, it also depends on the industry specific exogenous capital supply, $\overline{K}_s$:

$$w_s^{\#} = (1-\gamma) \rho_s \theta_s^{\delta} \frac{\bar{K}_s^{\gamma\delta}}{\bar{L}_s^{1-\delta+\gamma\delta}} \frac{\left[\frac{1}{S^{1-\delta}} \sum_{s=1}^{S} \left(\bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma} \theta_s\right)^{\delta}\right]^{\frac{1-\delta}{\delta}}}{S^{1-\delta}}. \tag{81}$$

Factor allocation and final output

Next, I present the aggregate economy production, that is given by a CES aggregation of industry level outputs. In turn, the latter come from simple C-D functions, which have sector specific exogeneous supplies of capital and labour along with aggregate productivity as arguments. Particularly, differently from both the fully integrated economy and the labour segmented economy, demand elasticities are not included within the aggregate output function, that only depends on input factors, i.e. capital and labour, and productivity.

$$Y^{\#} = \left[\frac{1}{S^{1-\delta}} \sum_{s=1}^{S} \left(\bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma} \theta_s\right)^{\delta}\right]^{\frac{1}{\delta}}. \tag{82}$$

On the other hand, at the firm level, production depends on both a sector level average of both capital and labour inelastic supplies and the relative productivity of the intermediate good producer. Of course, the more efficient the individual firm n, s, the larger the share of the industry aggregate output $Y^{\#}$ it will produce. Indeed, even at this level of production,

intra-sector demand elasticity does not matter.

$$q_{n,s}^{\#} = \frac{\theta_{n,s}^{\frac{1}{1-\rho_s}} \bar{K}_s^{\gamma} \bar{L}_s^{1-\gamma}}{\theta_s^{\frac{\rho_s}{1-\rho_s}} N_s}. \tag{83}$$

Finally, factor allocation of capital and labour at the firm level is a function of the average exogeneous allocation of the production resources, respectively, $\bar{K}_s$ and $\bar{L}_s$, and the relative efficiency of the firm. Crucially, in this case, distribution of factors do not depend at all on the within industry demand elasticity (labour is actually allocated in the same manner as in the labour segmented economy). Thus, if both the input factors markets are segmented at the sector level, then there is no distortion coming from demand elasticity heterogeneity across industrial sectors:

$$\begin{aligned} k_{n,s}^{\#} &= \frac{\bar{K}_s}{N_s} \frac{\theta_{n,s}^{\frac{\rho_s}{1-\rho_s}}}{\theta_s^{\frac{\rho_s}{1-\rho_s}}}, \\ l_{n,s}^{\#} &= \frac{\bar{L}_s}{N_s} \frac{\theta_{n,s}^{\frac{\rho_s}{1-\rho_s}}}{\theta_s^{\frac{\rho_s}{1-\rho_s}}}. \end{aligned} \tag{84}$$

Efficiency analysis

Finally, as fairly intuitively, if both capital and labour were segmented at the industrial sector level, then it would be possible to replace the first best solution by exogenously allocating in each sector as much capital and labour as the Social Planner would do. In fact, The Marginal Rate of Substitution is case of full segmentation is equal to:

$$MRS_{Y_1,Y_2} = \left(\frac{\theta_2 \bar{K}_2^{\gamma} L_2}{\theta_1 \bar{K}_1^{\gamma} L_1} \right)^{1-\delta}.$$

So, if both capital and labour are allocated according to the Social Planner solution, the MRS will exactly match the MRT:

$$MRS_{Y_1,Y_2} = MRT_{Y_1,Y_2} = \frac{\theta_2}{\theta_1}.$$

A.2 Construction of categories of four-digit C.O.I.C.O.P. items

Following is the list of the 58 products, classified according to the four-digit C.O.I.C.O.P nomenclature and grouped in seven broader categories, for which OECD provides CPI weights:

- *Food*: Bread and cereals; Meat; Fish and seafood; Milk, cheese and eggs; Oils and fats; Fruit; Vegetables; Sugar, jam, honey, chocolate and confectionery; Food products n.e.c.; Non-alcoholic beverages; Alcoholic beverages; Tobacco.

- *Housing*: Actual rentals for housing; Imputed rentals for housing; Materials for the maintenance and repair of the drilling; Services for the maintenance and repair of the drilling; Water supply; Miscellaneous services relating to the drilling; Electricity; Gas; Liquid fuels; Solid fuels; Heat energy; Furniture and furnishings, carpets and other floor coverings; Household textiles; Household appliances; Glassware, tableware and household utensils; Tools and equipment for house and garden; Goods and services for routine household maintenance; Restaurants, cafés and the like; Canteens; Accommodation services.

- *Apparel*: Clothing and Footwear.

- *Transportation and Communication*: Purchase of vehicles; Spare parts and accessories for personal transport equipment; Fuels and lubricants for personal transport equipment; Maintenance and repair of personal transport equipment; Other services in respect of personal transport equipment; Transport services; Postal services Telephone and telefax equipment and services.

- *Medical Care*: Medical products, appliances and equipment; Out-patient services; Hospital services.

- *Education and Recreation*: Education; Audio-visual, photographic and information processing equipment; Other major durables for recreation and culture; Other recreational items and equipment, gardens and pets; Recreational and sporting services; Cultural services; Games of chance; Newspapers, books and stationery; Package holidays.

- *Other goods*: Personal care; Personal effects n.e.c; Social protection; Insurance; Financial services n.e.c.; Other services n.e.c.

Table A-1 (I and II part) below presents means and standard deviations of CPI weights calculated across the items within each of the broad categories country by country. Note that in the Apparel sector is not reported because it includes only one good, that is Clothing and footwear.

Table A-1 (I part)

CPI weights (means and s.d.'s across sectors)

	US		**Canada**		**Mexico**	
	mean	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*
Food	0.96	0.51	1.34	0.82	2.43	2.27
Housing	2.26	5.0	2.00	3.75	1.56	2.75
Transport and Communications	2.20	2.05	2.65	2.09	2.17	2.18
Medical care	1.84	0.89	0.73	0.66	1.14	1.23
Education and Recreation	1.01	0.79	1.18	0.82	0.91	1.14
Other goods	1.10	1.12	0.54	1.04	0.67	1.32

Source: OECD database

Table A-1 (II part)

CPI weights (means and s.d.'s across sectors)

	Japan		**Germany**		**UK**	
	mean	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*
Food	1.8	1.01	1.17	0.67	1.35	0.83
Housing	1.87	3.10	2.19	4.69	1.86	2.84
Transport and Communication	1.44	1.04	2.05	1.21	2.21	1.61
Medical care	1.27	0.92	1.18	0.55	0.83	0.40
Education and Recreation	1.57	1.3	1.30	0.77	2.14	0.96
Other goods	0.97	0.11	1.17	0.86	1.07	0.92

Source: OECD database

A.3 Home bias evidence

The list of 2-digit (ISIC 3 Rev.) industries used for the empirical analysis presented in Figure 4.1 and Figure 4.2 in the Introduction section and in the next cases (Figure A-1, Figure A-2, Figure A-3, Figure A-4, Figure A-5) follows: Agriculture, hunting, forestry and fishing; Mining and quarrying; Food products, beverages and tobacco; Textiles, textile products, leather and footIar; Wood and products of wood and cork; Pulp, paper, paper products, printing and publishing; Coke, refined petroleum products and nuclear fuel; Chemicals and chemical products; Rubber and plastics products; Other non-metallic mineral products; Basic metals; Fabricated metal products except machinery and equipment; Machinery and equipment n.e.c; Office, accounting and computing machinery; Electrical machinery and apparatus n.e.c; Radio, television and communication equipment; Medical, precision and optical instruments; Motor vehicles, trailers and semi-trailers; Other transport equipment; Manufacturing n.e.c; recycling; Electricity, gas and water supply; Construction; Wholesale and retail trade; repairs; Hotels and restaurants; Transport and storage; Post and telecommunications; Finance and insurance; Real estate activities; Rent-

ing of machinery and equipment; Computer and related activities; Research and development; Other Business Activities; Public admin. and defence; compulsory social security; Education; Health and social work; Other community, social and personal services.

Figure A-1 and Figure A-2 show that final consumption, gross output and the number of firms at the 2-digit industry level are positively correlated in both the US and the UK even ten years before the period considered in Figure 4.1 and Figure 4.2 (i.e. middle 1990s). In more detail, it seems that such a correlation was even stronger for the US at that time.

Finally, Figure A-3, Figure A-4 and Figure A-5 show final household consumption, gross output and number of enterprises at the 2-digit industry level in the early 2000s for, respectively, the US , the UK and, moreover, Germany (just recall, as shown in Table 4.1, that the latter has been one of the top international trading partners for the US since the 1980s[45]) So, it seems that also in Germany, even though at a lesser extent than in the US and in the UK, there is home bias as long as industries whose products are more consumed are also those industries with a larger number of active enterprises.

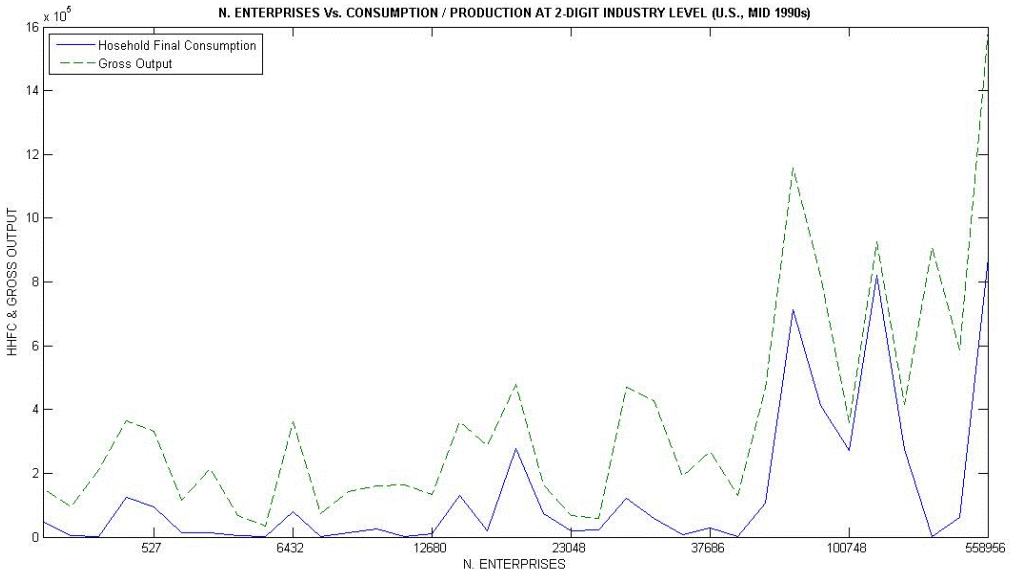


Figure A-1. Home bias. US, mid 1990s

[45]Note that SSIS does not provide the number of enterprises at the 2-digit industry level for Canada, Japan and Mexico (and for Germany in 1990s). Nevertheless to say, no data were available for China, as the latter does not belong to OECD.

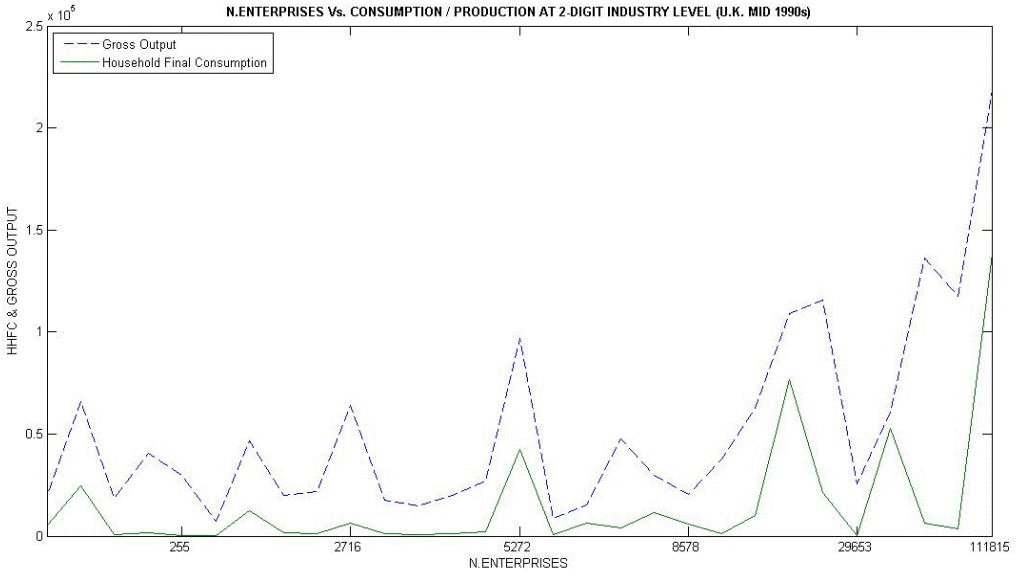


Figure A-2. Home bias. UK, mid 1990s

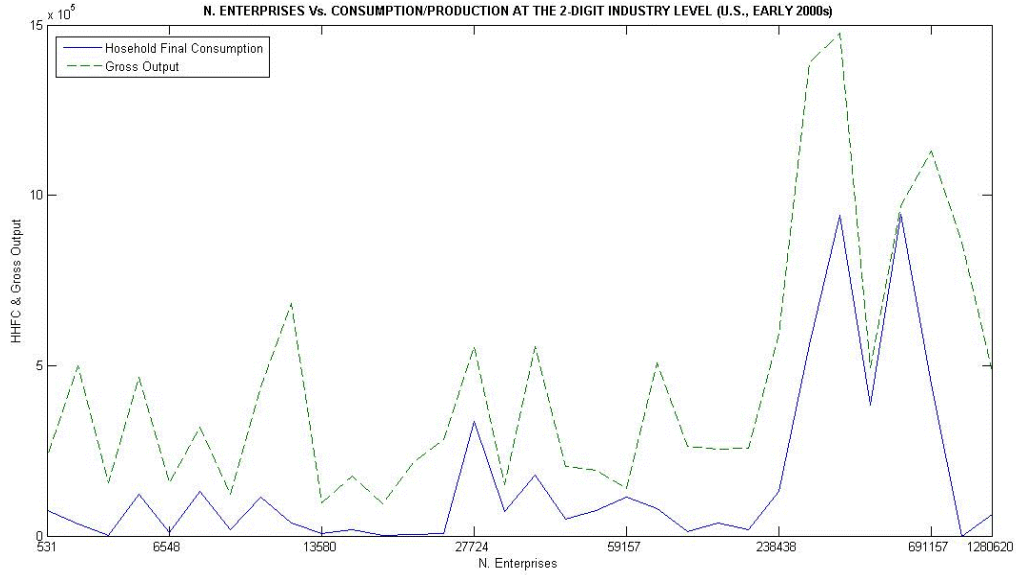


Figure A-3. Home bias. US, early 2000s

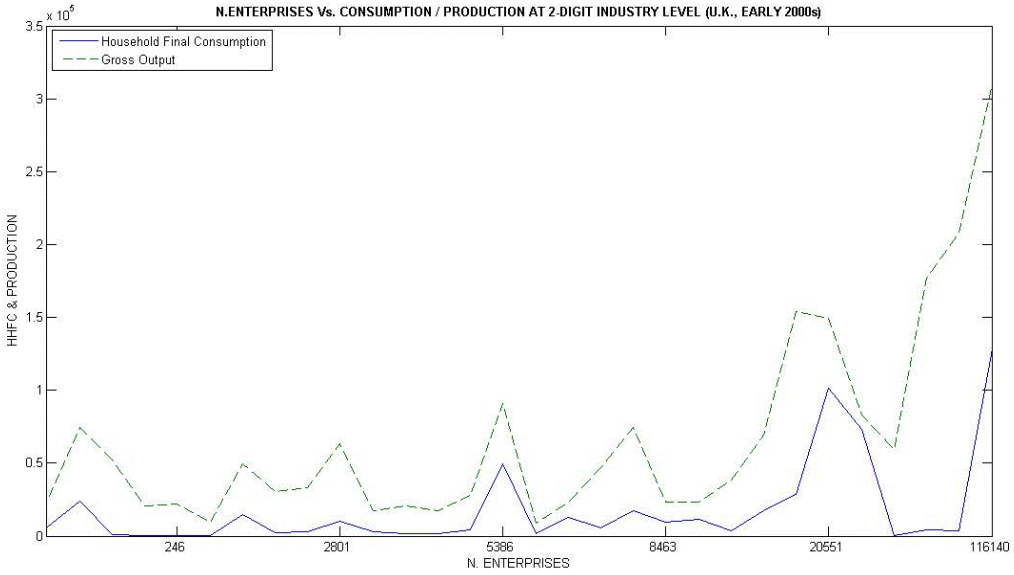


Figure A-4. Home bias. UK, early 2000s

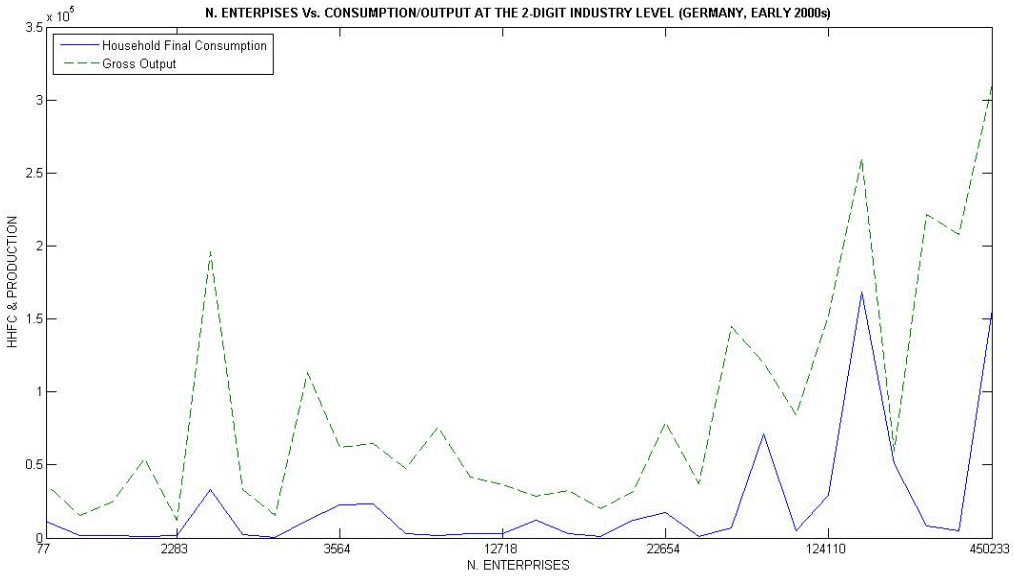


Figure A-5. Home bias. Germany, early 2000s

A.4 Construction of price indeces

The change in both producer and consumer price indeces is measured by expenditure share-weighted averages of the change in prices of individual firms. In more detail, according to this procedure, the change in the price index from time $t-1$ to time t takes into account only the price changes of individual firms that sell in both the time periods. In fact, as shown during the description of the model, aggregate productivity shocks crucially

affects the marginal costs of firms and, then, prices and profits. Therefore, the number of competitors can change between the two periods due to fixed costs of production and export. Thus, changes in aggregate prices indeces are constructed according to the following definitions. Note that subscripts denote country ($i = 1, 2$) , sector ($j = 1, ..., J$) and firm (domestic firm:$k = 1, ..., K$; foreign firm: $k = K + 1, ..., 2K$). Furthermore, the level of variables at time t (after the aggregate productivity shock) is indicated with a prime, while the level of variables at time $t - 1$ (before the aggregate shock) is indicated without the prime.

Thus, in country 1, the PPI change is given by summing up prices changes by domestic firms (placed in country 1) at home and abroad (i.e. in country 2):

$$\frac{PPI_1^{'}}{PPI_1} = \sum_{j=1}^{J} s_{1j} \sum_{k=1}^{K} s_{1jk} \frac{P_{1jk}^{'}}{P_{1jk}} + \sum_{j=1}^{J} s_{2j} \sum_{k=1}^{K} s_{2jk} \frac{P_{2jk}^{'}}{P_{2jk}}.$$

Note that the market share held by each firm k within its sector j in country i is defined by (53), while the market share held by each sector j within the whole national economy economy i is given by:

$$s_{ij} = \frac{P_{ij} y_{ij}}{P_i c_i}.$$

Furthermore, note that changes in prices charged in country 1 are weighted by both firm level and sector level market shares related to country 1, while price charged in country 2 are weighted by market shares related to country 2. In addition, the CPI change in country 1 is given by summing up price changes by domestic firms and foreign firms (from country 2):

$$\frac{CPI_1^{'}}{CPI_1} = \sum_{j=1}^{J} s_{1j} \sum_{k=1}^{K} s_{1jk} \frac{P_{1jk}^{'}}{P_{1jk}} + \sum_{j=1}^{J} s_{1j} \sum_{k=K+1}^{2K} s_{1jk} \frac{P_{1jk}^{'}}{P_{1jk}}.$$

Turning to country 2, the PPI change is given by summing prices up changes by firms placed in country 2 at home and abroad (i.e. country 1):

$$\frac{PPI_2^{'}}{PPI_2} = \sum_{j=1}^{J} s_{2j} \sum_{k=K+1}^{2K} s_{2jk} \frac{P_{2jk}^{'}}{P_{2jk}} + \sum_{j=1}^{J} s_{1j} \sum_{k=K+1}^{2K} s_{1jk} \frac{P_{1jk}^{'}}{P_{1jk}}.$$

On the other side, the CPI change in country 2 is given by summing up price changes by domestic firm and foreign firms (from country 1):

$$\frac{CPI_2^{'}}{CPI_2} = \sum_{j=1}^{J} s_{2j} \sum_{k=K+1}^{2K} s_{2jk} \frac{P_{2jk}^{'}}{P_{2jk}} + \sum_{j=1}^{J} s_{2j} \sum_{k=1}^{K} s_{2jk} \frac{P_{2jk}^{'}}{P_{2jk}}.$$

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